JOURNAL
OF
ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

VOL. 16 APRIL, 1923 No. 2

Proceedings of the Thirty-Fifth Annual Meeting of the American Association of Economic Entomologists
(Continued)

SECTION OF APICULTURE

Thursday, December 28, 1922, 8.15 p. m.

The session convened in the Auditorium of the Boston Society of Natural History with Chairman M. C. Tanquary presiding.

CHAIRMAN M. C. TANQUARY: I understand that a number of bee-keepers belonging to the local associations are present to-night, and I want to express our appreciation of having them meet with us. They should all feel free to discuss any of the papers that are presented.

I will now appoint the following Nominations Committee: Dr. E. F. Phillips, Dr. W. E. Britton, and Professor G. A. Dean.

Secretary Bentley acted as chairman and the annual address was given by Chairman Tanquary.

RELATION OF THE TEXAS AGRICULTURAL EXPERIMENT STATION TO BEEKEEPING IN TEXAS

By M. C. TANQUARY, *Chief, Division of Entomology, Agricultural Experiment Station; State Entomologist, College Station, Texas*

ABSTRACT

The Texas Agricultural Experiment Station is conducting investigational work in bee keeping with head quarters in Bexar County, near San Antonio, Mr. H. B. Parks in charge. It is planned to make a thorough study of honey plants and of nectar secretion. There are two experimental yards in charge of well versed, practical bee keepers, one in southwest Texas and the other in north Texas and also small apiaries at each of seven different sub-stations.

The foul brood control work is vested in the chief of the Division of Entomology as State Entomologist with two inspectors attached to the office and ten local inspectors distributed in various parts of the State. A numerical summary of the work is given. Treatment for American foul brood is discouraged and destruction of the infected colonies urged.

The relation between the Texas Agricultural Experiment Station and beekeeping in Texas is two-fold. In the first place, the Experiment Station, through the Division of Entomology, is conducting investigational work in beekeeping, and in the second place the Chief of the Division of Entomology, as State Entomologist, is in charge of the foulbrood control work of the state. I will first discuss briefly the investigational work.

Investigational Work in Beekeeping

At the present time the headquarters for the investigational work in beekeeping is in Bexar County near San Antonio, to which place it was moved from College Station this past summer because of the exceedingly poor beekeeping possibilities in the vicinity of the latter place. A ten-acre plot of ground was purchased and an attractive and substantial brick laboratory building, containing an office, a laboratory, and a large store-room, was erected. In the near future it is planned to build a residence for the apiculturist. Mr. H. B. Parks, who is well-known to the beekeepers of the country through his work and writings, is in charge. Extensive planting will be made of all the honey-plants which grow well under the climatic and soil conditions obtaining in that part of the state in order to aid in a thorough study of honey-plants and of nectar secretion. The main apiary will be located here, and out-apiaries will be established in the surrounding country with the idea of making a study of all the problems of the commercial beekeeper.

About four miles from the headquarters laboratory is the experimental queen yard which is in charge of an expert queen breeder, Mr. A. H. Alex, a graduate of the Texas Agricultural and Mechanical College, who works under the direction of Mr. Parks. Here studies of the various problems of queen breeding are carried on. Queens are reared to supply the experimental apiaries in the state where they are tested for the various qualities that are considered desirable in queens. Each year the surplus queens are sold to the beekeepers of the state, selling not more than three to any one beekeeper, in order to obtain as wide distribution as possible and thus aid in bringing up the general level of quality of bees throughout the state, and especially in getting the average beekeeper to appreciate more fully the importance of good queens.

Two experimental yards have been established to study special problems in two of the most important honey producing regions of Texas, one at Dilley in Southwest Texas, where mesquite (*Prosopis glandulosa*), huajilla (*Acacia berlandiera*) and catsclaw (*Acacia greggii*) are the

principal honey plants, and the other at Roxton in the black land cotton belt of north Texas. Both of these apiaries are in charge of well-versed practical beekeepers. The colonies comprising the two yards were donated by the beekeepers of those portions of the state in which they are located.

A new feature of the work this past year has been the establishment of a small apiary (5 colonies) at each of seven different substations of the Agricultural Experiment Station. Some very interesting results were obtained with these, especially where new territory was tested. At one of these stations in northwest Texas, so far as we could learn, there had never been a single colony of bees in the county, and everyone told us that bees would either be blown away by the high winds or at least starve to death. These 5 colonies were installed as 3-frame nuclei about the middle of May. By the middle of August, or exactly three months afterwards, one colony, in addition to drawing out 21 frames of foundation, had produced approximately 100 pounds surplus of as fine honey as I have ever seen. The other four colonies also had the 10-frame Langstroth brood-chambers filled with brood and honey and all the way from 15 or 20 to 45 or 50 pounds of honey in the supers.

In two other counties, one of which had previously contained but three colonies, and the other but two or three small beekeepers, the substation bees did almost as well for the season. This work will be continued this coming season and extended to other parts of the state.

Foulbrood Control

The second phase of the relationship between the Experiment Station and beekeeping in Texas comes through the foulbrood control work which is vested in the Chief of the Division of Entomology as State Entomologist. The plan for carrying on the work is as follows:

First, one or two inspectors are sent out from the office who put in practically all of their time in field work during the inspection season, which lasts from early in February to about the first of November. One of these men, Mr. C. S. Rude, has had general charge of the field work during the past three years. In addition there are ten local inspectors, located in various parts of the state, who take care of situations in their respective territories which cannot be handled promptly by the men sent out from the office.

We are very fortunate in Texas in that we have no European foulbrood, the American being the only form that we have had to deal with so far in a regulatory way.

A great deal of the work in the early part of the season is necessarily devoted to the inspection of the apiaries of queen breeders and shippers of package bees. This past season we granted 40 queen breeder's certificates, representing 14,098 colonies of bees. Most of these are located in parts of the state that are free from disease and would not require an annual inspection merely from the standpoint of foulbrood eradication. Therefore, this work, and the considerable amount of inspection which is required by people who want to move bees out of the state, or from one part of the state to another, decreases very greatly the amount of work which is directed specifically toward the eradication of American foulbrood.

The following is a general summary of the inspection work done in Texas during the fiscal year ending August 31st, 1922:

Number of colonies inspected	45,530
Number of cases of American foulbrood	618
Number of cases of American foulbrood destroyed	541
Number of cases of American foulbrood treated	77

Treating for American foulbrood is discouraged as much as possible and destruction urged in its place. We have become convinced that destruction is, in general, and in the long run, the cheapest and best method of dealing with this disease, and we have great hope that by following the present policy we will be able to entirely eradicate American foulbrood in Texas in the not very distant future. The beekeepers of the state as a body have endorsed our general policy looking toward foulbrood eradication, and it is because of their loyal support and cooperation that we hope ultimately to succeed in that effort.

MR. S. B. FRACKER: I would like to ask whether the number of cases given is the number of colonies or the number of apiaries?

CHAIRMAN M. C. TANQUARY: It is the actual number of colonies.

MR. L. HASEMAN: Have you had any opposition from the queen breeders, when you sent out, say, three queens to any one beekeeper?

CHAIRMAN M. C. TANQUARY: Many of the people who have urged this particular work are queen breeders themselves. They are strongly back of that. I have heard of perhaps one or two who mentioned the possibility that we might interfere a little with their work as queen breeders, but when we have explained that our queen breeding is only ex-

perimental, and we limit out distribution to three queens to a beekeeper, they do not object.

MR. GOLDFARB: How much do you pay your inspectors?

CHAIRMAN M. C. TANQUARY: The one who has general charge of the field work receives at the present time $2100 per year and expenses while in the field. He has been with us for several years now. The other we usually start in at $1200 per year, and if he stays with us over that period, increase it as we can. The one mentioned as having general charge of the field work does other work than that of an inspector during about two or three months of the year.

Chairman Tanquary resumed the chair.

CHAIRMAN M. C. TANQUARY: The next paper on the program is

UTILIZATION OF VARIOUS CARBOHYDRATES AS FOOD FOR THE HONEY-BEE

By E. F. PHILLIPS, *Washington, D. C.*

(Withdrawn for publication elsewhere)

MR. R. N. CHAPMAN: Do you know anything about the energy efficiency of a bee? How efficiently is it built up?

MR. E. F. PHILLIPS: You mean in muscular activity?

MR. R. N. CHAPMAN: How much of it goes to muscular activity, in reproduction, and so on?

MR. E. F. PHILLIPS: The only work which would answer that, is the work of Milner and Demuth, and their measured heat production agreed closely with the calories in the food consumed.

MR. L. HASEMAN: I would like to ask whether diastases have been discovered in the alimentary canals of bees, as such.

MR. E. F. PHILLIPS: There are no examinations for any of the enzymes on the inside of the alimentary tract. They have all been made by taking the entire tract, the muscles and all adhering. There are no examinations of extracts from the juices which are contained inside the alimentary tract.

CHAIRMAN M. C. TANQUARY: The next paper is by W. J. Nolan.

A TWO-YEAR BROOD CURVE FOR A SINGLE COLONY OF BEES

By W.J. NOLAN, *Bureau of Entomology*

ABSTRACT

The earlier work is briefly reviewed. Investigations were begun in 1920, weekly counts being made, but during 1921 and 1922 photographic records were taken, sea-

sonal records for fifty-three colonies being now available. In the vicinity of Washington brood rearing shows three major phases:—1. an abrupt rise from the beginning in March to the maximum peak in May, 2. a pronounced summer decline extending from the maximum until early August and 3. a late summer secondary peak and subsequent autumn decline. The first is of great importance and the peak should be reached three weeks before the honey flow. The second phase or summer decline is dependent in its rate upon the amount of incoming nectar or pollen. The third or final phase shows the amount of brood which can be cared for in early spring and is the one which may spell success or failure for the first phase of the next year. There is a direct relation between nectar flow and brood rearing. Prolonged inclement weather may retard brood rearing in the spring, though this may be overcome by strong colonies. A strong colony tends to remain strong.

The question of what actually takes place in brood-rearing throughout the active season is one concerning which very little of value has been published. It is true that there have been many conjectures and many attempts to estimate the number of eggs a queen is capable of laying in a single day, but all available records of periodic brood counts throughout an entire season may be counted on the fingers of one hand.

The earliest authentic count of the number of eggs laid by a queen in a single day was made in 1856 by von Berlepsch, the German investigator. He managed to confine the egg-laying activity of a certain queen to a single comb during twenty-four hours. A count then showed 3021 eggs. This number has since become classic, having been adopted widely as a proper index of a queen's daily egg-laying capacity. From this number von Berlepsch assumed that a queen might be capable of laying 1,300,000 eggs during her lifetime. Cheshire (p. 228) thought it a mere trifle to add 200,000 to this total, and he gives 1,500,000 as his estimate, adding that this is "a number so vast that the eggs, lying in contact end to end, would stretch about one and three-quarters miles." Many later attempts to ascertain the daily egg-laying rate have been made. Typical of these is that given by Doolittle in *Gleanings in Bee Culture* during 1918. Because he had estimated roughly that a certain colony possessed on one occasion sufficient brood to fill completely 18 to 20 Gallup frames, he concluded that the queen in this particular colony had been laying 5,000 eggs daily.

All such sporadic attempts to find out the daily egg-laying rate are highly interesting, of course, but after all they give little aid in any endeavor to determine what is going on in the way of brood-rearing throughout the season. This is all the more true because only too often the work has been done for an exceptional queen for a single day at the height of the season's activity. With this point in mind it is readily seen that no

accurate idea may be formed from such evidence as to what really takes place in brood-rearing throughout an entire season.

In America as early as 1859, Baldridge had conceived the idea of determining the egg-laying rate throughout the season by periodic counts. He actually made one such count of all the eggs, larvae, and sealed brood in each frame of a certain hive. The task was evidently too arduous, inasmuch as it was not continued further. Nevertheless the report of this single count as published in the first volume of the *American Bee Journal* (1861) forms the earliest available brood census.

It was nearly forty years later before anything of real value appeared on this problem. In 1895 Baldensperger published in *Gleanings in Bee Culture* some estimates made throughout the active season at intervals of from two to four weeks of the amount of brood in a given colony in Palestine. It must be admitted that, although these estimates are not absolutely accurate, they do furnish a fairly reliable index of what in general takes place throughout the year. This seems to be the first published work giving the results of periodic counts or estimates for such a length of time. Previously, as already stated, the results for a total season were mere calculations based simply on the results of a single count at the height of egg-laying activity.

The year 1901 marks an epoch in such investigations because at that time Dufour in the *Annuaire de la Fédération des Sociétés Françaises d'Apiculture* published the results of actual counts of brood made at intervals of twenty-one days from 1897 to 1900 inclusive, a period of four years. In the first three years he used two colonies, and in the fourth year only one colony. The magnitude of this work may be realized when it is borne in mind that Dufour actually counted each egg, larva, and sealed cell.

In 1919 Brünnich published in *Der Schweizerische Bienen-Zeitung* the brood curve of a single colony for the year 1918. His work, unlike Dufour's, is based, not on an actual count of each cell containing brood, but on a mathematical calculation of the number of such cells derived from linear measurements made throughout the season of the brood area on each frame, the number of cells in any chosen linear unit being well known.

Such in brief were the few outstanding attempts to throw light on the subject before 1920. In that year work was begun in this field at the Bee Culture Laboratory. For this purpose in 1920 five colonies, in 1921 sixteen colonies, and in 1922 thirty-two colonies were used. In 1920 weekly counts were actually made of all brood, both sealed and un-

sealed. During 1921 and 1922 a photographic method was employed whereby photographs were taken weekly of every frame containing sealed brood, and counts made later from the negatives, the sealed brood only being counted because of its greater clearness. As a result of the continuance of this work for three years, there are now available counts of brood made at weekly intervals during an entire active season for fifty-three colonies. The curves which form the basis of this paper are from one of these colonies for two consecutive seasons.

It is a matter of common apiary experience that the brood increases rather rapidly in the spring up to a maximum and then falls off during the remainder of the year. The rapidity with which the maximum is reached is especially striking in regions of early honey-flows with no later honey-flows of consequence. Furthermore, it is generally recognized that brood-rearing naturally reaches its maximum at or just after the height of the honey-flow. This is attested by the existence of such apiary practices as dequeening during a honey-flow, removing brood, and the like. Nevertheless, a clear definite understanding has not yet been reached of all of the factors causing increased brood-rearing activity or its decline. Nor has it been established whether the brood-rearing curve is regular and uniform in its rise to the maximum and in its subsequent decline, or whether breaks and irregularities may not occur both in the rise and decline. It is of interest then to glance at the seasonal brood curve of some individual colony.

The colony whose brood-rearing activity during 1921 and 1922 is described in this paper was located at the Bee Culture Laboratory at Somerset, Md. It was wintered unpacked in two, 10-frame Langstroth hive-bodies. During the course of the two years nothing whatever was done to stimulate brood-rearing. The queen, however, was allowed to roam at will through the hive. Although there was no restriction to any possible expansion of the brood area, on no occasion was brood found outside of the first three hive-bodies. The queen used throughout both seasons had been introduced into the colony in late summer in 1920 as soon as she had commenced to lay. In brief, each spring found this colony with a fairly strong force of bees, a prolific queen, combs composed chiefly of worker cells, and no shortage of stores.

To determine its seasonal brood-rearing activity, counts of all of the sealed brood in this colony throughout both seasons were made once each week. From these counts brood curves for each season have been constructed, these curves being so similar that they will be discussed as one. They show quite clearly that in the vicinity of Washington the

brood-rearing activity of the season may be divided into three major phases: (1) an abrupt rise from the beginning of brood-rearing in March

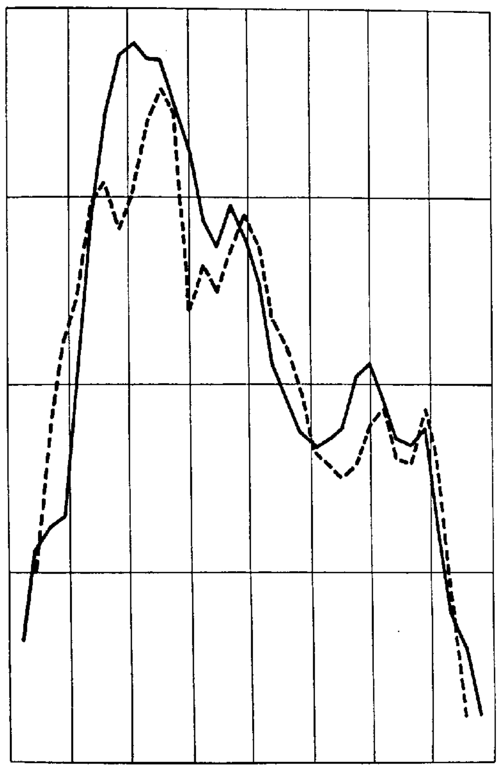

Fig. 2.—Brood curve for 1921 shown by broken line, that for 1922 by unbroken line. Vertical divisions represent months from March to October inclusive; horizontal divisions represent 5000 cells of sealed brood each.

until the maximum peak is reached at some time in May under normal conditions, (2) a pronounced summer decline extending from the maximum until early August, and (3) a late summer, secondary peak and subsequent autumn decline.

The first phase of the curve is all-important to the beekeeper during any current season, because a successful crop depends on the proportion

of the bees represented by the maximum peak which actually go to the field during the honey-flow. Under ideal conditions this peak would be reached three weeks before the honey-flow, and it is the constant endeavor of every alert beekeeper to have his colonies attain this peak at that time.

In the colony in question the maximum in 1922 was reached two weeks earlier than in 1921, although in the latter year a more auspicious beginning had been made. This was occasioned by the unusually early spring in 1921 during which nectar and pollen were coming in abundantly throughout March. During the two weeks following the 29th of March, however, there were six occasions on which the temperature reached the freezing point. Nightly during this same period the temperature dropped well below the clustering point. On four occasions the thermometer did not register over 57° F., for twenty-four hours, and on another occasion 62° F., was the highest temperature for forty-eight hours. Not only the effect of such weather on the nectar and pollen sources, but also the direct effect of the lower temperatures on the activity of the colony finally caused a break in the amount of sealed brood in the latter half of April. Although a recovery in the rate of brood-rearing was made subsequently, the peak was reached only after the chief source of nectar at Washington, the tulip-tree, was already in bloom. In 1922, on the other hand, there was a late spring, inclement weather in early March causing a temporary shortage of pollen in the hive. These conditions are clearly reflected in the curve for that month. Nevertheless, April weather more than compensated for a backward March, and by the end of the month nearly all flowers were as advanced as in the previous year. The result was a tremendous rise in the brood curve, causing the maximum to be reached two weeks in advance of that of the year previous. It was also in advance of the tulip-tree honey-flow for 1922, but just at a time when locust was in bloom. This caused brood-rearing to remain at its high level for about two weeks after the peak had been reached.

The second phase, or summer decline, is dependent in its rate upon the amount of incoming nectar or pollen. The decline during 1922 was gradual, there having been only a slight upward break in the middle of June due to an abundance of pollen. During the same month in 1921 there was a similar, upward break, but owing to two causes it was more pronounced. In the first place, as a result of the break during the rise to the maximum, the additional cells which would have been used for brood, had the brood area expanded continuously throughout the rise as

in 1922, had already been used for nectar and pollen coming in during the period between this break and the peak. When the maximum was reached, tulip-trees were yielding and many cells in the brood-nest proper were being used for nectar. Due to these circumstances the queen was partially restricted in egg-laying for several days, and in consequence the brood curve for 1921 drops from its maximum more sharply at first than is the case in the curve for 1922. Consumption or removal of the nectar in the brood area soon gave the queen more room, which she promptly used, thus making the curve at this point comparable again to that of 1922. The second cause of the more pronounced upward break of the curve during June, 1921, is due to the fact that associated with the incoming pollen of this month there was an exceptionally large amount of honeydew available, and also nectar from sweet clover in appreciable quantities. During both years the curves for the remainder of the summer decline follow courses almost parallel until the beginning of the final phase is reached in August. At the end of each season's second phase brood-rearing activity had been reduced to a point only one-third as great as that represented by the maximum for the same year.

The third, or final phase, is the one which may spell success or failure for the first phase of the succeeding year, because during it the young bees emerge which winter over and determine the amount of brood which can be cared for in early spring. In both 1921 and 1922 two minor peaks occurred during this final phase. The first of these represented a very intense pollen yield, and the second the fall nectar flow. After the latter peak there was a rapid decline until brood-rearing ceased completely. All in all, except for minor deviations due to differences in weather conditions, the curves of this colony during the two successive years present striking similarities.

In neither of these seasons did the queen approach any such rate as found by von Berlepsch in his experiment covering only twenty-four hours. For the colony to produce the total amount of sealed brood found in the hive during 1921, it was necessary for the queen to lay 202,830 eggs during the season, or an average of 905+ daily for 224 days. The total amount of sealed brood in 1922 represents 213,076 eggs, or an average of 895+ daily for 238 days. Although the total for 1922 is larger than for 1921, yet the average daily egg-laying rate is lower because the season in 1922 lasted 34 weeks instead of only 32 weeks as in 1921. The highest daily rate during any 12-day period in 1921 was 1488, while the highest daily rate during any similar period in

1922 was 1587. These figures may be compared with Dufour's maximum daily average of 1627 during one 21-day period. On the other hand his highest daily rate for any period of at least 32 weeks was only 791 eggs, as compared with the daily egg-laying rates of 905 and 895 for 1921 and 1922 respectively. Baldensperger in his rough estimates gives 930 eggs as a daily average over a period of 344 days. At the end of his article already referred to, Dufour makes a statement which applies with equal effect to the colony used in this research. Although he recognizes that the egg-laying rates which he publishes are only averages and, as such, were undoubtedly exceeded at times, yet he justly asserts that the results of his work do not warrant the assumption that any such daily egg-laying rate as 3000 or more had ever been reached in any of the colonies used in his experiments. Since the daily egg-laying average for any season is far below the daily egg-laying average for any particular number of days within that season, it is readily seen that the remarkably high rates of egg-laying over short periods, so often published in beekeeping literature, can not be used as the daily averages for an entire season.

The following general conclusions may be drawn from the curves presented here, assuming sufficient bees in the spring, a good queen, plenty of stores, good combs, and proper insulation.

(1) There is direct relation between nectar flows and brood-rearing activity. This also holds true for incoming pollen.

(2) Prolonged inclement weather may retard brood-rearing in the spring, although a strong colony may be able to maintain its rate through unfavorable, cold weather of only a few days duration, even though it is unpacked.

(3) Under such conditions as obtain naturally from year to year, a strong colony tends to retain its strength, as is evidenced by the remarkable similarity in brood curves found during two successive seasons in the same colony.

CHAIRMAN M. C. TANQUARY: If there is no discussion, I will read the paper of J. H. Merrill.

VALUE OF WINTER PROTECTION FOR BEES[1]

By J. H. MERRILL, *Apiarist, Kansas State Agricultural College and Experiment Station*

ABSTRACT

Previous work is briefly summarized. The data secured during the past four years are tabulated and show that a wind break made an average difference of 8,600 bees in a one story, unpacked hive, 7,968 in a two story, unpacked hive and 3,539 in a packed hive, indicating that packing will to a certain extent offset the disadvantage of a wind break. A packed hive in a wind break shows a decided advantage over unpacked hives.

The behavior of the honey bee during the winter season has been carefully studied by Phillips and Demuth[2] and it is not intended to present in this paper any new facts concerning behavior of bees during the winter season, but rather to give some specific figures on the results which beekeepers may expect by applying the facts given by these authors.

Regardless of how clear an explanation may be of the necessity for following any line of procedure, if it involves work or expense, there will always be a large number of people who will claim that either the practice is not necessary for their locality, or else that it is too expensive.

An experiment has been carried on at the Kansas State Agricultural Experiment Station to secure data on the value of winter protection for bees. Phillips and Demuth have plainly shown that a colony of bees, in order to winter successfully, must have: First, a large number of young bees; second, plenty of good stores well placed; third, protection from prevailing winds, and fourth, sufficient packing with some insulating material. Why these are needed is carefully explained, and it was the purpose of the Kansas experiment to show definitely the value of applying these principles.

The results of the first three years' work have been reported[3] in which it was explained that two series of hives were used in the experiment, one set of which was protected by a dense windbreak of shrubbery, while the other was placed in the open. In each set there were used one

[1]Contribution No. 83, from the Entomological Laboratory, Kansas State Agricultural College. This paper embodies some of the results obtained in the prosecution of project No. 126 of the Agricultural Experiment Station.

[2]Phillips, E. F., and Demuth, G. S.—Outdoor Wintering of Bees. U. S. D. A. Farm. Bul. 695, pp. 12, 1915.

Phillips, E. F., and Demuth, G. S.—The Preparation of Bees for Outdoor Wintering. U. S. D. A. Farm. Bul. 1012, pp. 20, 1918.

[3]Merrill, J. H.—Preliminary Notes on the Value of Winter Protection for Bees. Journ. Econ. Ento., Vol. 13, No. 1, 1920, pp. 99–111.

Merrill, J. H.—Further Notes on the Value of Winter Protection for Bees. Journ. Econ. Ento., Vol. 14, No. 1, 1921, pp. 111–114.

one-story hive and one two-story hive, all of which were left unpacked. In addition to these there were in each set a two-story hive placed in a packing box and insulated with four inches of packing beneath, six inches on the side, and eight inches on top. Each colony was requeened in August with a young queen and all of the queens used each year were from the same mother. In the two sets of hives—both the packed and unpacked—it was planned to leave sufficient stores to carry the colonies through until the honey flow began. In other words, it was attempted to have conditions in all of the colonies as nearly similar as possible in the fall of the year.

As a standard of what constituted good wintering, it was agreed that those colonies which possessed the greatest number of bees at the beginning of the honey flow were those which had wintered the best. In the fall of the year, and again in the spring, the number of bees in each hive was determined by a system of weighing in which a pound represented 5000 bees.

The results of the first two years' work with this experiment were published in the first paper. The results of the third years' work appeared in the second paper on this subject. As all of the results of this experiment have a similar trend, the data secured from the fourth years' work, which have not been published, will be averaged with the data secured from the first three years' observations.

Table 1 presents an average of the data secured in the four years during which this experiment was conducted.

TABLE NO. 1.—AVERAGE WINTER GAIN OR LOSS FOR FOUR YEARS

Date	No Windbreak			Windbreak		
	No. 2 1-story Unpacked	No. 16 2-story Unpacked	No. 4 2-story Packed	No. 5 1-story Unpacked	No. 6 2-story Unpacked	No. 7 2-story Packed
1917 1918	-332	2,808	4,566	4,538	13,346	15,132
1918 1919	-3,282	469	22,968	313	5,936	24,844
1919 1920	625	-1,250	5,625	10,000	8,125	3,800
1920 1921	-25,358	-1,525	*	-8,800	4,029	47,575
Average gain or Loss	-7,087	-109	11,053	1,513	7,859	22,838

*Hive number four was blown over by the wind during the winter of 1920–1921, and was eliminated that year.

Where the result indicated is preceded by a minus sign, it signifies that there were fewer bees in the hive when it was weighed in the spring than in the fall. Where the result stated is a positive number, it indicates that there were more bees in that hive in the spring than in the fall. It will be noticed that during the winter of 1919–1920, neither

hive No. 16 nor hive No. 7 had as many bees as might have been expected.

Since it was the purpose of this experiment to ascertain the best methods of wintering, the failure of these two hives should be explained. The explanation is simple—they both lacked sufficient stores. On April 19th, the stores in colony No. 7 were practically exhausted. While this was indeed unfortunate for those individual colonies, it was fortunate for the experiment as a whole. Colony No. 7 had only an increase of 3,800 bees; whereas, had it had sufficient stores, the number might have been about ten times as many. The same condition applies to colony No. 16. Sufficient stores were left in all of these hives to amply supply their needs through an ordinary winter and spring. However, a severe freeze on Easter Sunday killed all of the fruit bloom; consequently, more honey was needed. An examination of the two colonies which were deficient in stores showed much less brood than any of the others, which would indicate that if the stores in a hive were nearing exhaustion, the daily rate of egg-laying would be materially lowered. This emphasizes the necessity for leaving plenty of stores.

The most marked results on the value of winter protection were those obtained during the winter of 1920–1921, which was very mild and open with frequent opportunities for the bees to take flight. In fact, it was very similar to winters in those parts of the country where the remark is often heard that "there is no need of packing our bees because we have such mild, open winters." Colony No. 7, which was not only packed but protected by a windbreak, had 47,575 more bees in the spring than it had in the fall, while the one-story unpacked hive in the open had 25,358 less bees in the same year, which would seem to answer the above quoted objection. A study of the results noted in Table II indicates that a windbreak is of much greater importance than is ordinarily believed.

TABLE II—VALUE OF WINDBREAKS

	No. 5 1-story unpacked	No. 6 2-story unpacked	No. 7 2-story packed
Protected by windbreak	1513	7859	*14,592
	No. 2	No. 16	No. 4
Unprotected by windbreak	7087	-109	*11,053
Advantage of windbreak in number of bees	8,600	7,968	3,539

*Colony No. 4 was blown over by the wind during the winter of 1920–1921 and was eliminated from the experiment for that year. It was during that year that colony No. 7 showed the greatest supreiority over unpacked hives; therefore, it seems reasonable to infer that colony No. 4 would likewise have shown a marked superiority, but as No. 4 was eliminated by accident, No. 7 should be eliminated during that year as well, hence, this table shows an average of three years' work instead of four.

The data recorded in this table show that the one-story hive in the windbreak had an average advantage over the one-story hive in the open of 8,600 bees. The two-story, protected hive had 7,968 more bees, while the packed hive in the windbreak, for a three-year average, had the advantage of 3,539 bees over the unprotected, packed hive. When it is not possible to have a windbreak, good packing will, to a certain extent, overcome this disadvantage. A dense mass of shrubbery protected the bees on the north, west, and south sides, while the east side was protected by a grove of trees. A study of Table III will show the marked advantage of packed over unpacked hives.

TABLE III.—VALUE OF PACKING

	Windbreak		No Windbreak	
	1-story	2-story	1-story	2-story
Packed	22,838	22,838	11,053	11,053
Unpacked	1,513	7,859	-7,087	-109
Four year average difference	21,325	14,979	18,140	11,162

The packed hive in the windbreak had an average of 21,325 more bees than the one-story hive, and 14,979 more than the two-story hive. In those hives unprotected by a windbreak, the difference in numbers is not quite so marked, yet there is a wide margin, as the packed hive had an average of 18,140 more bees than the one-story hive, and 11,162 more bees than the two-story hive.

Since there are about 5,000 bees to a pound, and as they are worth $2.00 a pound at present, it will be seen that beekeepers may incur considerable expense for packing and still be the gainers. Furthermore, the beekeepers will have the advantage of having these bees in their own hives at the right time of the year, which might not be the case if they were obliged to depend on strengthening their colonies with package bees.

TABLE IV.—VALUE OF SUFFICIENT ROOM IN THE HIVE

	Windbreak	No Windbreak
2-story	7,859	-109
1-story	1,513	-7087
Four year Average Difference	6,346	6,978

When the one and two-story unpacked hives are compared, it will be seen that the two-story hive has an average advantage of 6,978 bees. When the similar hives, protected by a windbreak, are compared, the two-story hive will be found to have 6,343 more bees than the one-story hive. This difference is due to the fact that when the two-story hives are used it is possible to leave more stores, have them better arranged, and at the same time provide sufficient room for spring brood rearing. Judging from these facts, it would appear that if these conditions could

be met in a single hive body which would have the added advantage of having only one set of combs, the bees ought to winter better even than in the two-story hives. Some of the larger hives now in use should meet these requirements.

Summary

1. The purpose of this experiment was to show, by specific figures, the results obtained by applying the best known methods for wintering bees.
2. Six hives containing a known amount of honey and a known number of bees were placed on scales, and daily readings taken of all changes in weight.
3. Three of these hives were sheltered by a windbreak, while the others were not.
4. Each set of three consisted of one one-story hive, one two-story hive, and one packed hive.
5. In addition to making daily readings of the changes in weights, a general weighing was made at the beginning of the honey flow in the spring to determine the number of bees in the colonies on that date.
6. It was shown that a two-story hive, unprotected, averaged 6,346 more bees than a one-story hive similarly placed, and that in the windbreak the two-story hive averaged 6,978 more bees than the one-story hive.
7. It was shown that the windbreak made an average difference of 8,600 bees in a one-story, unpacked hive, 7,968 in a two-story, unpacked hive, and 3,539 in a packed hive.
8. It is indicated that if a windbreak is not available, added packing will, to a certain extent, offset this disadvantage.
9. It was shown that unless sufficient stores are left in the hive, the queen will not lay eggs to her fullest capacity.
10. It was shown that the packed hive in the windbreak has an average advantage of 21,325 more bees than the one-story, unpacked hive, and 14,979 more bees than the two-story, unpacked hive. Where there was no windbreak, the packed hive had an average advantage of 18,140 more bees than the one-story, unpacked hive, and 11,162 more bees than the two-story, unpacked hive.

MR. GREEN: Something was said in regard to the opportunity to fly during the winter. Provided they have an abundance of supplies and

a good queen, does not a great deal depend upon an opportunity for them to have a chance to fly through the winter?

CHAIRMAN M. C. TANQUARY: I believe a great deal depends on the opportunity for flight. The figures were averages taken over a period of four years and in the latitute in which they were taken, there is very seldom a winter when there is more than two or three weeks without a chance for flight of the bees.

MR. GEORGE A. DEAN: Since the bees in both the packed and the unpacked hives in Dr. Merrill's experiment had the same opportunity for flight during the winter, the comparison as shown in the chart is a fair one. You will notice in the chart before you that there is a big difference between the packed and the unpacked hives.

MR. GREEN: About three years ago we had an extreme shortage of bees here and the price increased greatly. The scarcity was due to extremely cold weather during the previous winter. The bees had no opportunityto fly although they had an abundance of stores. If they can fly twice during the winter, you can feel pretty sure of getting them through successfully.

CHAIRMAN M. C. TANQUARY: The next paper is entitled "Rehabilitation Classes in Apiculture," by E. N. Cory.

REHABILITATION CLASSES IN APICULTURE

By E. N. CORY, *College Park, Md.*

ABSTRACT

Bee keeping fits admirably in the scheme of rehabilitation of ex-soldiers, since it offers relatively large returns on the time and money invested and gives seasonal employment on clear days amid pleasant surroundings. A two term course in bee keeping is offered by the University of Maryland to beginning students of the Veterans Bureau supplemented by project work in connection with their placement training.

Vocational training in agriculture of ex-soldiers presents many problems. Not the least of these is the initial one of determining what fields of agricultural endeavor thei· mental attitudes, finances and physical disabilities permit them to enter. Most soldiers who come to the eastern training centers are socially inclined, that is, they, and especially their families, want to be near or in cities, towns or villages. For the most part, they have come from such an environment, and they want to return there at the end of their training. Few evince the pioneer spirit that has been so manifest after our previous wars, when virgin lands were opened to settlement.

With such a mental attitude, rehabilitation courses should be along the agricultural lines, practicable near or in cities and villages.

The production of small fruits, vegetables, flowers, the raising of poultry and the keeping of bees, offer the best opportunities with this environment in view.

Finance plays an important part in the choice of vocation. The activities mentioned may be entered upon with less capital than the larger farm enterprises. Returns on the investment may be expected more quickly, which is certainly a desideratum.

Many in training are handicapped by physical disabilities, which preclude continuous exertion day after day for eight or ten hours per day. Others, through the loss of a hand, a foot or a leg can do only certain limited kinds of physical labor. To these must be added those who have mental troubles, which make for despondency, the magnification of bodily ills and the worry of small things gone awry.

Beekeeping fits admirably in the scheme of rehabilitation for men so handicapped, offering a relatively large return on time and money invested; giving seasonal employment, to be performed only on the clear or sunshiny days amid pleasant surroundings, and requiring study of its many problems that will engage the mind with a tendency to exclude the ex-soldier's mental troubles.

What to give the trainee to fit him to keep bees in a short time is, of course, debatable. It has seemed to the writer that however desirable a study of behavior is as a basis for the necessary operations of keeping bees, the operations or manipulations themselves should be stressed, at least in the first or beginning course.

With this in view, a two term course is offered to beginning students of the Veterans Bureau, supplemented by project work in connection with their placement training. The first term's work consists of one lecture and three hours in the laboratory per week. The lectures are illustrated by stereopticon, supplemented by exhibit material. Short quizzes are given on single, concrete questions as each natural division of the subject matter is finished. The laboratory work is designed to familiarize the student with his equipment, tools and apparatus.

One laboratory period is devoted to a study of the worker, drone and queen bee. Mimeographed outline drawings about eight inches long, of the three types of bees are given to the students, together with specimens, and the student required, by aid of text books, demonstrations, dissections and projected pictures, to place on the outline drawings, certain important structures and to label the parts of the bee.

Each student is furnished with a complete knocked down body, bottom board, cover, comb super, extracting super, sections, frames,

foundation and accessory parts. Under the guidance of a practical beekeeper as instructor, and with the aid of exact directions, the complete hive is set up, the supers outfitted ready for the bees and the equipment painted. Few beekeepers do this exactly right, and for the student to do it correctly requires some concentration. Each student now has a hive ready for the colony, which is either furnished as package bees or made up form a single frame nucleus during the spring term.

Wax extraction, liquefying and bottling honey, its grading according to color, body, clarity and nectar sources, and its sale, are each given ample attention.

The balance of the winter term is utilized in making up home-made devices, such a frame wiring apparatus, foundation fasteners, field tool boxes, etc.

The second term no lectures are scheduled, but informal lectures are given by the instructor during each laboratory period, which is spent in the bee yard, except when inclement weather prevents.

Stimulative feeding (its use and abuse), winter protection, in part, taught at time of unpacking, uniting, equalizing, swarm control, comb and extracted honey production, the simplest queen production and the establishment of nuclei, are the points stressed.

At the same time, familiarity with handling bees by actual manipulation by each student every laboratory period is insisted upon. Full protection by veils, leggings and gloves is required at first, but as confidence is acquired the student is allowed to dispense with the protection if he so desires.

Project work follows and consists of the establishment of at least one colony of bees on the farm where the trainee is getting his placement training. If he owns, or has a long lease, on the place where he is in training and seems adapted to beekeeping, he is encouraged to establish an apiary. Projects are visited at frequent intervals by the instructor, for the purpose of aiding the student in handling his bees, and to check up on his progress.

Wintering methods are worked out on the project, and those who wish to continue and seem to have the proper aptitude are given advanced class work, wherein the fundamental behavior problems and special topics are dealt with in detail.

CHAIRMAN M. C. TANQUARY: We will pass to the next paper by S. B. Fracker.

PROTECTING AMERICAN BEES AGAINST THE INTRODUCTION OF THE ISLE OF WIGHT DISEASE

By S. B. FRACKER, *Madison, Wis.*, C. B. GOODERHAM, *Ottawa, Canada*, and GEO. H. REA, *Reynoldsville, Pa.*

ABSTRACT

Legislation to prevent the introduction of the "Isle of Wight" disease in America has been enacted during the summer in both the United States and Canada, following a series of conferences and suitable publicity, the bill being finally drawn so as to regulate the importation of all honey bees. The bill is reprinted in the paper.

Legislation to prevent the introduction of the Acarine or "Isle of Wight" disease into America has been enacted during the past summer in both the United States and Canada. The leading part in the adoption of this legislation was taken by the section on apiculture of this association in cooperation with the Bureau of Entomology, United States Department of Agriculture.

Since its discovery in 1904 on the Isle of Wight, this disease spread with comparative rapidity and recently had become the most feared of all known maladies of the honey bee. Its ravages at the place of discovery were soon duplicated in other parts of the British Isles and before 1920, the rate of mortality of infected colonies was believed to be one hundred per cent. Alarm at the manner in which the infection was spreading and the rate at which diseased apiaries were being wiped out resulted in extensive investigations to determine the cause.

On November 1, 1920, Dr. John Rennie of Aberdeen, Scotland, announced the discovery of a mite parasitic in the respiratory tract of infected bees, which proved to be constantly associated with this disease. The mite was described as a new species and given the name *Tarsonemus woodi*, later being placed by Hirst in a new genus, *Acarapis*.

Previous belief that the "Isle of Wight" disease was caused by a protozoon, *Nosema apis*, of world-wide distribution, and that its virulence was due to some environmental condition in the British Isles had lulled American Beekeepers to a sense of security. Dr. Rennie's discovery changed the situation and investigations were carried on during 1921 by the Bureau of Entomology to determine, first, whether the mites were present in the United States, and second, whether they could be imported in commercial shipments of queen bees and their attendants. As a result the mite has thus far not been found on the American continent, but, in the case of an experimental shipment of bees from Scotland, they survived a transatlantic trip, showing conclusively that their introduction in this way is possible.

The presentation of these facts to the apicultural section of the Ameri-

can Association of Economic Entomologists at the Toronto meeting in December, 1921, caused the adoption of a resolution favoring legislation to protect American bees from this parasite. The authors of the present paper were appointed as a committee to sponsor such legislation in the United States and Canada, and cooperated with Dr. E. F. Phillips of the federal department of agriculture to this end.

As a result of a conference called at Washington, D. C., on March 9, 1922 an additional committee on publicity was appointed, consisting of J. G. Sanders, president of this association, E. G. Carr, New Brunswick, N. J., and F. Eric Millen, Guelph, Ontario, whose newspaper and journal articles were largely responsible for the public support given the bill at its committee hearings and on the floor of the House and Senate.

The first step in the direction of a general quarantine consisted of a postal order, issued by Acting Second Assistant Postmaster General E. R. White, on March 21, 1922, prohibiting "the importation of honeybees through the regular and parcel post mails," with the proviso that "this prohibition does not apply to bees imported from Canada." The order was issued promptly upon presentation of evidence showing its desirability, and appropriate notice given to European countries through the International Bureau at Berne. It came in time to protect the United States for the season of 1922.

Shortly thereafter, the Deputy Minister of Agriculture of Canada issued an order under the Dominion Animal Contagious Diseases Act specifying that "On and after the first day of May, 1922, the importation into Canada of bees, used or second hand hives, or raw hive goods or products, excepting honey or wax, from the Continent of Europe, is hereby prohibited owing to the danger of introducing a contagious disease of bees known as 'Isle of Wight' disease" A supplementary letter from the Minister stated that this order covered Great Britain and Ireland which are considered European countries.

Bills providing similar legislation for the United States were introduced into the Senate by Senator Norris and into the House of Representatives by Congressman Haugen on April 22, 1922. At the House committee hearing this association was represented by Prof. E. N. Corey and Dr. Phillips, and at the Senate hearing by Dr. Phillips.

The bill (H. R. 11396) passed the House of Representatives on June 5, and the Senate on August 23, and was approved by the President on August 31, 1922, going into effect at once.

In the meantime the mite causing the disease was found in several additional European countries, making it clear that the federal regula-

tions must cover a wider territory than the British Isles. Dr. Ellinger of Weimar is authority for the report that it has been discovered in Germany; Professors Bouvier, Leclainche, Vallee, Berland and Mamelle of Paris have shown its presence in different parts of France; and according to the *Schweizerische Bienenzeitung* it also occurs in Switzerland. The exact extent of the area to which the prohibition will apply is to be determined by the Secretary of Agriculture. as will be seen from the provisions of the bill.

In connection with the committee hearings a certain amount of opposition developed by correspondence, all of it based on the assumption that the quarantined area would include the countries from which Caucasian and Carniolan bees are imported. The bee journals, however, gave generous space to the proposed legislation, the American Honey Producers League arranged for the appointment of a committee to cooperate with the members of this association, and prominent beekeepers and inspectors wrote their congressmen favoring the bill. The assistance of George S. Demuth and E. R. Root, was especially valuable as they appeared in person before the House and Senate committees respectively.

The United States has suffered so extensively from European, Asiatic, and African pests and diseases of plants and animals that the present move is a most encouraging one. The Acarine disease, if introduced, would perhaps not wipe out honey production completely, but it would unquestionably add new and serious difficulties to profitable beekeeping, materially increase the cost of production, and make the occupation more hazardous than it is at present. One of the members of the House committee, while apparently forgetting the battle raging over horticultural "quarantine 37," nevertheless expressed his approval of the principle involved by commending the bill and adding: "This is the first time in my experience that a scientific department of the government has advocated the stopping and stamping out of disease before we had to spend a lot of money in hunting it up in this country."

The act as passed, which may be obtained as document 293 of the 67th congress, is as follows:

A BILL to regulate foreign commerce in the importation into the United States of the adult honeybee (Apis mellifica).

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to prevent the introduction and spread of disease dangerous to the adult honeybee, the importation into the United States of the honeybee (Apis mellifica) in its adult stage is hereby prohibited, and all adult honeybees offered for import into the United States shall be destroyed if not immediately

exported: *Provided*, That such adult honeybees may be imported into the United States for experimental or scientific purposes by the United States Department of Agriculture: *And provided further*, That such adult honeybees may be imported into the United States from countries in which the Secretary of Agriculture shall determine that no diseases dangerous to adult honeybees exist, under rules and regulations prescribed by the Secretary of the Treasury and the Secretary of Agriculture.

Sec. 2. That any person who shall violate any of the provisions of this act shall be deemed guilty of a misdeameanor and shall, upon conviction thereof, be punished by a fine not exceeding $500 or by imprisonment not exceeding one year, or both such fine and imprisonment, in the discretion of the court.

CHAIRMAN M. C. TANQUARY: The next paper is by E. F. Phillips.

ISLE-OF-WIGHT DISEASE, WITH SPECIAL REFERENCE TO GEOGRAPHICAL DISTRIBUTION

By E. F. PHILLIPS, *Washington, D. C.*

(Withdrawn for publication elsewhere)

CHAIRMAN M. C. TANQUARY: These two papers are now open for discussion.

MISS MORSE: Would the bee die before you knew what was the matter with it, if it had these mites in it?

MR. E. F. PHILLIPS: It is difficult to answer that question because the symptoms of arsenical poisoning, bee paralysis and other diseases to which the bee is heir, are identical. With the Isle-of-Wight disease there is more of a tendency for the bee to crawl than with the others.

We are anxious to have suspicious bees sent to the Bureau of Entomology for observation. In 1921 and 1922 beekeepers sent bees to us from all over the country, and in all cases they were found to be free of the mites. So the hope is getting stronger every day that we do not have it.

After the approval of this law, about which you all know, on August 31, it became necessary to give attention to what countries should be exempted from the operation of the law under its provisions, and what method should be used for permitting importation of bees. I have drawn up some material here which is not intended for publication, but it is some proposed regulations, which would not interfere unduly with beekeeping but would provide all the safeguards intended by the law. I will read these and I want you to understand that we should be de-

lighted to have suggestions of any kind sent in. Just as soon as we can arrange it, we will have a hearing on these regulations so that everyone will have an opportunity to say what he feels.

Perhaps it is not quite the thing for me to make this recommendation, but the committee which was appointed last year did such good work that it seems to me that it might be desirable and advantageous for this Section to appoint a committee to continue with this work until such time as satisfactory regulations have been adopted.

I was about to say that the same committee should be continued. The only objection to that is that Mr. Gooderham from Canada is a member of the committee, and he is naturally not concerned with the regulations within the United States. I have no objection, of course, to Mr. Gooderham personally, but he would hardly be a man to continue on the committee. With that one change, I think it would be fine to have the same committee continued.

CHAIRMAN M. C. TANQUARY: What is your pleasure regarding this matter? It seems to me it would be well to have the same committee continued with the addition of one man in place of the one member from Canada who consequently should not be on the committee. It might be well to leave the selection of that one man to the present members of the committee. They might choose someone to work with them, unless someone wishes to move otherwise.

Voted that the committee select another member to replace Dr. Gooderham and continue its work throughout the year. The committee subsequently selected Prof. E. N. Cory of Maryland.

MR. L. HASEMAN: I would like to ask to what extent at present do we get Carniolan bees?

MR. E. F. PHILLIPS: There has been a small trade in Carniolan bees but of course during the war it was impossible to get the Carniolan stock as long as they were on the other side of the battle front. After the war there were, I should say, several dozen queens brought in. I do not assume that it is the function of the Federal Department of Agriculture under this law to regulate what sort of bees the beekeepers of the country should use.

It seems to me the regulations should be made with regard to the safety of the importations rather than their prospective size.

If we could get information from Carniola, which so far has been impossible, it would be different; but we do not know whether they have disease or not.

Mr. L. Haseman: It seems to me that for several years we have had no way of finding out anything of those countries.

Mr. E. F. Phillips: The situation is not favorable for taking up the necessary investigations in any of those countries.

Secretary G. M. Bentley presented a resolution stating that on account of the amount of apicultural matter that was being published in the Journal of Economic Entomology, that the Section bring to the attention of the general association the desirability of having one member of the Section on the Advisory Board of the Journal. He stated that this resolution was offered not as a criticism of the present management but with the desire to make the Section of Apiculture as effective as possible.

The resolution was adopted.

The Committee on Nominations recommended the following officers for the ensuing year: Chairman, S. B. Fracker; Secretary, G. M. Bentley.

The report was accepted and the members named elected.

Adjournment, 10.30 p. m.

SECTION OF HORTICULTURAL INSPECTION

Friday, December 29, 1922

The meeting of the Section of Horticultural Inspection convened at 9.45 A.M.

In the absence of Chairman R. W. Harned, Mr. E. N. Cory was called upon to preside.

Chairman E. N. Cory: We greatly regret the absence of Professor Harned, but since he is not present, I will appoint the following nominating committee: Mr. W. E. Britton and Mr. A. G. Ruggles. The first paper will be by Mr. C. L. Marlatt.

WORK OF THE FEDERAL HORTICULTURAL BOARD

By C. L. Marlatt

(Abstract)

It was pointed out that the publications of the Board made available a full record of its various activities, namely, the Service and Regulatory Announcements issued at irregular intervals, the Annual Report, and the various quarantines, notices of hearings, and explanatory circulars.

Discussing the growth of the work, it was stated that this work now involves the services of 150 technical men and some 75 State collaborators, and appropriations which will total for the current fiscal year $820,430. It was noted also that the Board is concerned in the enforcement of various quarantines and regulations thereunder on appropriations made to the Bureaus of Plant Industry and Entomology, which, together with the appropriations made directly to the Board, make a total of upwards of $2,000,000 expended in plant regulatory and special pest control work. The present status of the important subjects of such control was given.

The importance of the port and border control work was explained at some length, the character of the organization—State and Federal—and the effort which was being made to strengthen and increase this service which now involves a Federal expenditure of some $200,000, including the Mexican border work, and a State expenditure of perhaps $100,000.

A brief general discussion was given of the 22 foreign and 15 domestic quarantines being enforced under the plant quarantine act and of the present status of Quarantine 37, and particularly of the very much improved public reaction toward this quarantine involving its hearty endorsement now by practically all of the State, National, and regional associations related to plant production.

A brief discussion was also given of the proposed restrictions which are being considered in relation to foreign fruit and vegetable imports to prevent the entry into the United States of the many important fruit and vegetable flies which are prevalent in most foreign countries and which so far, fortunately, the United States is free from.

MR. T. J. HEADLEE: May I add a word on the Japanese beetle situation. From the time of its first discovery in 1916, to and including 1921, the economic damage done by this insect was so slight as to fail to convince perhaps the majority of the people, living in the most heavily infested portion of the district, that the insect was sufficiently injurious to merit an attempt to bring it under control. In 1922 the economic damage was sufficient to cause almost a complete reversal in sentiment. It is significant, however, that even in 1922 orchards thoroughly sprayed were not in any case seriously injured.

The ability of the Japanese beetle to do serious harm depends upon its abundance, and even when it becomes sufficiently abundant to do harm, crops may be protected by thorough spraying. It does not seem likely that further increases in numbers will reduce the

effectiveness of spray because, if the beetles feed upon the foliage, which has been sprayed with four pounds of powdered arsenate of lead to fifty gallons of water, 60 % to 70% die.

Furthermore, the data indicate that natural enemies are already beginning to make a reduction in numbers. It is true that this reduction, which is only about 2% does not, in any way equal the percentage of increase, but it may be taken, I think, as a straw indicating the way in which the wind is beginning to blow.

Crops that are constantly cultivated throughout the beetle season, do not show during the fall or the following spring any considerable number of grubs in the soil. Plowing or disking the soil to a minimum depth of four inches just after the frost makes its first appearance in the ground seems practically to clean up Japanese beetle grubs.

Natural enemies from Japan are being introduced into the infested district. It is planned to examine Korea, Northern China and Northern India for additional, probably effective species.

A quarantine designed to prevent the insect from being distributed on the "long jump" is being vigorously and apparently effectively enforced. This quarantine has both state and inter-state features and it is enforced by the laboratory organization, working under the immediate direction of Mr. C. W. Stockwell, who has charge of the quarantine division of the Japanese Beetle Laboratory. To show you the severity with which this quarantine is being administered I have only to point out that a nursery of considerable size, located within the infested district and devoting the majority of its energy to the production of evergreen shrubs and trees is completely unable to do business in plants of this kind outside the quarantine area. The enforcement of this quarantine offers hard conditions to a nursery of this sort but the safety of the rest of the country at large demands that this procedure be carried out, until some practical method of cleaning the earth ball has been discovered. As the normal spread of the insect goes on, more nurseries of this sort will be found to be included within the infested district, and the interference with the normal business carried on by those concerns will be very large and the losses entailed will, I believe, be very considerable.

Appropriations for the adequate carrying out of this work against the Japanese beetle have in the past been forthcoming and larger ones seem in immediate prospect, not only from the United States government but from the states of New Jersey and Pennsylvania.

CHAIRMAN E. N. CORY: We will now listen to a paper by Mr. Leonard Haseman.

INSPECTING NURSERY STOCK AT DIGGING TIME

By LEONARD HASEMAN, *Columbia, Mo.*

ASTRACT

Great opportunities are offered in inspection work. Summer inspections are inadequate and inspections at digging time with a uniform system of certification, probably regional, is suggested.

The writer's fifteen years experience with Plant Inspection work in Missouri has convinced him that no other line of work offers greater opportunities for real service to Agriculture and Horticulture. Yet many states have been slow to recognize the importance of the work and to adequately provide for its proper enforcement. Even the United States Department of Agriculture did not get effective legislation passed until long after a number of serious foreign plant diseases and insect enemies of agriculture had been introduced. With the arrival of the San Jose Scale in the United States many of the states became active in passing hurried legislation which in most cases was later replaced with broader and more carefully drawn legislation. Missouri comes in this group.

The present Plant Inspection Service was created by the Legislature in 1913. It was 1919, however, before any funds were appropriated for carrying out the work. Previous to that the Agricultural Experiment Station furnished the inspectors and the field expenses were paid by the growers receiving inspection. In 1921 the biennal appropriation was increased to $10,000 and the next one will undoubtedly be further increased. Still the funds are far inadequate to make it possible to organize the work on a basis to properly meet the needs of the state.

INSPECTION WORK

Under our present organization the annual inspection of nurseries, floral establishments, berry fields and sweet potato slip beds has always been carefully done. However, in the past few years we have had definite proof of the fact that summer inspection is not sufficient. It is all right so far as it goes but where scale, crown gall and the like appear, the nurseryman needs further help later and the inspection service is under obligation to give it. The culling out of infested or diseased trees or plants is the duty of the inspectors and should not be placed as an obligation on the nurseryman. In the

past we have been obliged to extract from the nurseryman in the form of a sworn statement, a promise to make our certificate mean what it says when placed on a shipment. That other states have been obliged to do the same in the past is evident from the fact that each year some scale infested stock is shipped and delivered to fruit growers with state inspection certificates attached. All inspectors of experience know that this is true and yet it can hardly be avoided unless the summer inspection is followed by actual inspection of every tree in the fall or spring at digging time.

Inspection at Digging Time

That we must come to the regular practice of inspecting and culling all nursery stock at digging time is the opinion of many inspectors and nurserymen alike. That it will be expensive and difficult to administer is perfectly apparent. Yet if conscientiously carried out it will revolutionize plant inspection work. Uniform inspection laws administered under varying degrees of laxness can not possibly accomplish much toward actual uniformity of results as desired. However, if a competent inspector looks at every tree as it comes from the ground from every nursery in the United States and destroys every tree that fails to pass inspection, then and only then can we really say that we are rendering the service nurserymen, fruit growers and farmers have a just right to expect of us. Then and only then can we honestly place our stamp of approval in the form of a certificate on shipments of nursery stock.

This year the Missouri Plant Inspection Service has added to its regular annual summer inspection work the inspection of stock at digging time. All the small nurseries found infested with scale or dangerously near infested orchards and one of the largest nurseries in the state, at the request of the owners received this added service. About three hundred acres received inspection at digging time this fall. With the co-operation of the nurserymen the work can be carried along rapidly. The most conspicuous troubles with trees are readily apparent to any experienced foreman and can be discarded by him in the field when lifted from the ground. In this way one man can in a few days inspect and cull all the stock grown by a small nurseryman and two or three men can handle the stock as fast as the larger firms can bring it in from the field, especially if the haul is fairly long. For a state like Missouri with one hundred nurseries scattered over an area roughly three hundred miles square this will

necessitate the use of a considerable force for one or two months. But suppose it does it will be far cheaper than to have a veritable army of inspectors, as some states maintain, to run down and inspect each small order or bundle of trees at points of destination. It will be cheaper to the states as a whole, far cheaper and more satisfactory to the nurserymen and better protection to the buying public.

Intense Culling

It may be of interest to many of the state and federal inspectors to hear that associated with this program in Missouri, a number of our larger growers have entered upon a program of culling severely and let the public pay the price for clean, number one stock. Firms that have been discarding faulty trees, due to crown gall, aphis, hairy root and like troubles to the extent of 25% are now considering a cull up to 50% if need be. One firm receiving inspection at digging time is culling in the field to the extent of 60% of all trees of certain varieties. In this case the inspector has been throwing out on an average only one or two trees in a thousand after they reach the packing sheds. This is indeed culling with a vengeance for this particular nursery is on ideal soil remote from orchards and they have always grown exceptional stock.

In one of the smaller nurseries receiving inspection at digging time and where scale has gotten in, the inspector has been throwing out for all troubles about $1,000 worth of trees a day. The most encouraging part of the work is the fact that the nurserymen are calling for this help with culling and are giving every assistance with their field and packing house crews.

A Suggestion

Without going further into details about the present work in Missouri the writer wishes to say again that it appears to him as tho this is the only real solution of the inspection of nursery stock in the future. It is the only fair and just way of inspecting and certifying stock. It will stop trouble before it leaves the nursery and if all state and federal forces will co-operate it will prove also the most economical plan.

At this point I wish to offer one suggestion for your thoughtful consideration. We have long discussed the importance of uniform inspection and all agree that if possible to attain it, it would be a great thing. Here we have an opportunity to really enter upon a

plan that will come as near giving what we desire as we can ever hope for. In the past we have fallen short of our aim due to variation in requirements and methods and to the influence of geographical location on the dangerous insects and plant diseases of nursery stock. By inspecting at digging time the first two factors can be largely eliminated and a committee selected geographically could largely iron out the third difficulty. Funds and men are the outstanding difficulties we have encountered and a further suggestion here will bear on that point.

In the first place why should Mississippi, for instance, be forced to maintain a staff of inspectors to inspect at point of delivery all small or large shipments of stock from Missouri and other states. Would it not be cheaper and more satisfactory for Missouri to spend say one half that amount on inspection at digging time when all these small orders are assembled at one or a few packing houses perhaps. The inspection and movement of nursery stock is no longer a state matter but one of inter-state and national importance. The various states and the Federal Departments should closely co-operate in carrying it out effectively. Why could there not be a regular staff of state and federal inspectors, with uniform training, grading uniformly, working from the north toward the south as the fall advances. A combined state-federal certificate or a straight Federal Horticultural Board Certificate could be issued. In fact following out the purpose of federal quarantine regulations a grower might be given a certificate which would enable him to ship stock only to certain areas should any insect pest or disease appear which might be important only in certain parts of the country. We have already the beginning of such federal aid and co-operation; is it not feasible to extend it to include all interstate control of nursery insects and diseases which is really the present purpose of our nursery inspection work. I offer these suggestions for the thoughtful consideration of the State and Federal inspectors present and later during the business sessions if the matter is considered worthy of more serious consideration a committee, of which Dr. Marlatt should be a member and preferably, chairman, might be appointed to look into the possibility of such a basis of future co-operation and betterment of our nursery inspection work throughout the country. If the plan is workable and will render greater uniformity and cleaner, better stock then we can certainly count on the co-operation of the nurserymen of the country.

MR. L. S. MCLAINE: I was glad to hear Mr. Haseman's discussion on the inspection of nursery stock at the time of packing. Up to the present time I know there has been great concern in inspecting imported shipments from other countries or other states, but when it comes to the inspection of outgoing shipments from particular areas, there is not as much care given, and blanket certificates have been issued with only a single summer inspection.

In Canada we are contemplating a modification of our regulations dealing with the importation of nursery stock from the United States and one clause that is receiving very serious consideration is one which will require the inspection at time of packing of shipments from the United States and consigned to various Canadian points.

I regret to say that in numerous shipments from various states, inspection showed that these were not as free from pests as one would like. I think the time will come— and I hope it will not be far off— when nurserymen will be impressed with the idea that it is necessary to ship only clean plants, and that no certificates should be given unless the plants are clean and free from all pests and diseases.

SECRETARY A. F. BURGESS: In connection with the gipsy moth work, we have always followed the plan of making inspections at the time of shipment. This includes an examination of lumber, stone, and quarry products as well as of nursery stock that is going outside of the quarantined area. Inspection at the time of digging and shipment of nursery stock is undoubtedly the best way of preventing the spread of injurious pests; nevertheless, in the enforcement of such inspections there is serious difficulty in securing efficient men for the short rush season that covers the shipping period in spring and fall. It requires a large number of men who should be well trained and efficient and the time for active work is limited. If some plan could be devised whereby a number of men of this type could be provided with other work to carry them through the rest of the season, I believe that inspection at the time of shipment would be entirely feasible, if you wish to get results and do not believe you can depend on local inspectors hired temporarily; for if the work is important enough to do, it should be done well; otherwise, you miss the protection that you desire to secure.

MR. L. S. MCLAINE: Possibly some of you know that the State of Idaho contemplates the establishment of a series of inspection stations through which all shipments must enter and be examined.

SECRETARY A. F. BURGESS: While I have not been in very close

touch with nursery inspection for some time, I do know in a general way that the complexities of inspection from the nurserymen's point of view are continually increasing. Years ago the nurserymen were not willing to support a plan designed to bring about more uniformity. Possibly at the present time sentiment has changed in this respect. It seems to me that a method such as that outlined by Mr. Haseman should be considered thoroughly and that it might result in a more simple system than is in operation at present.

CHAIRMAN E. N. CORY: We will now listen to Mr. Rockwell who represents the Nurserymen's Association.

BUGS, BUGOLOGISTS, BUGABOOS AND NURSERYMEN

By F. F. ROCKWELL, *Bridgeton, N. J.*

(Paper not submitted for publication).

CHAIRMAN E. N. CORY: The next paper is by Mr. R. Kent Beattie.

IMPORTANT PLANT DISEASES COLLECTED ON IMPORTED NURSERY STOCK IN 1921 AND 1922

By R. KENT BEATTIE, *Pathologist in charge Foreign Plant Quarantines, Federal Horticultural Board*

ABSTRACT

Quarantine 37 seeks to reduce the risk of importing foreign plant diseases and insect pests by limiting the entry of plants to those necessary and by surrounding such entry as is permitted with the safeguards of (1) Freedom from soil, (2) Importation in safest form, (3) Inspection on entry, (4) Disinfection, (5) Field inspection, (6) Port inspection of baggage and freight. A list of important plant diseases intercepted during the years 1921 and 1922 is appended.

The establishment of Quarantine 37 in 1919 and the subsequent development in the methods of its enforcement have increased the safeguards thrown around the importation of nursery stock and have somewhat modified the system of inspection previously used. This quarantine has now been in operation for three and a half years and it would seem opportune that the system of safeguards and inspection should be summarized.

The Horticultural Inspectors of the country are fully aware of the fact that every plant imported carries with it the risk of bringing some plant disease or insect pest. The quarantine seeks to reduce this risk to a minimun both by limiting importation and by safeguarding material the importation of which is necessary.

The first great safeguard is the rule that plants must be freed from sand, soil, and earth. The necessity for this rule was largely established by years of observation and inspection on the part of State and Federal inspectors and need not be further discussed here.

The second safeguard is the limitation of imported plants to the safest form in which material which will meet the needs can be imported. The leniency, for example, which the quarantine exhibits toward the introduction of seeds of trees and shrubs is due to the belief that wherever the material involved will come true from seed it is safer to introduce it in that form. Root, stem and leaf diseases and insect pests are thereby largely eliminated and the seeds will usually withstand more easily necessary disinfection.

The third safeguard is inspection on entry. The inspection system varies in regard to different types of plants and may be classed as follows:

(1) Bulbs permitted unlimited entry, included in Regulation 3, Item (1), namely:

Lilium, Convallaria, Tulipa, Hyacinthus, Crocus, and Narcissus and beginning with January, 1, 1923, Chionodoxa, Galanthus, Scilla, Fritillaria meleagris, Fritillaria imperialis, Muscari, Ixia, and Eranthis which together with Narcissus will then be permitted unlimited entry for a period of not exceeding three years.

If these bulbs first arrive in the United States at one of the ports where the Federal Horticultural Board maintains a port inspection service they are met at that port, the inspection is completed, and the necessary notices are there required; if their first arrival is at a port other than the above, notices are filed with the Collector of Customs and the State Inspector of the state of destination is notified of their arrival and their inspection is in his hands.

(2) Fruit stocks, cuttings, scions and buds of fruits, and rose stocks and seeds covered by regulation 3, Items (2), (3), (4), and (5) are superficially examined at the port of first arrival for compliance with the requirements as to certificate and markings, the proper notices are required and the plants are forwarded to destination for inspection by the State Inspector.

(3) If the importer desires to import seeds by mail a special mail permit is issued to him and special mail tags are furnished him which direct the shipment to Washington, D. C., or San Francisco, California, as may be most convenient and the material receives direct Federal inspection.

(4) Plants imported for propagation under Regulation 14, whether by freight, express or mail are moved to Washington or San Francisco in a manner similar to class 3.

The fourth safeguard is disinfection. This, where necessary, is performed by vacuum methods for any material reaching the inspection house at Washington or for such other material as requires disinfection at the port of first arrival. For example all seeds from the Orient and from out of the way countries receive cyanide fumigation with a vacuum.

The fifth safeguard is field inspection for one to five years in the growing season of the plants imported under Regulation 14 for propagation. Federal inspectors visit the nurseries.

The sixth safeguard is the force of port inspectors who prevent the entry of plants and plant products other than as provided in the regulations, who assist the customs officers in the search of passengers baggage, crew's quarters and ship's stores and who are constantly searching for possible loopholes by which plant diseases or insect pests may enter the United States.

Interceptions of plant diseases or insects such as are reported to you by the Pathologist or by the Entomologist of the Board may therefore come from several sources:

(1) From Federal Inspectors or State Collaborators at ports of first arrival.

(2) From State Inspectors at the destination of the material.

(3) From Federal Inspectors at Washingtom, D. C. or San Francisco, California.

(4) From Federal Inspectors working over propagating stock in the field during the growing season.

Since a report on plant interceptions was not made in 1921 I append a list of important interceptions of plant diseases during the last two years together with the country of origin of each.

List of Plant Interceptions in 1921 and 1922

Host	*Disease*	*Country*
Agropyrum scabrum	Urocystis agropyri	Tasmania
Citrus aurantium	Pestalozzia sp.	Canal Zone
Citrus grandis	Cladosporium citri	Mass., Hawaii, Cuba
" "	Pseudomonas citri	Siam
" "	Phomopsis citri	Brazil, Porto Rico
Citrus sinensis	Phomopsis citri	Panama, Cuba.
Citrus sinensis	Bacterium citri	Japan
Citrus	Pseudomonas citri	Japan (2)
Citrus	Phomopsis citri	Japan

Host	*Disease*	*Country*
Citrus nobilis	Cladosporium citri	Japan
Cocos nucifera	Colletotrichum	Cuba
" "	Pestalozzia	Cuba
Cucumis melo (Honey dew melon)	Alternaria sp.	Africa
Cydonia vulgaris	Sphaeropsis malorum	Argentina
Dianthus caryophyllus	Heterosporium echinulatum	England
" "	Uromyces caryophyllinus	France
Dracaena torminalis	Aspergillus niger	Brazil
Dracaena massangeana	Aspergillus niger	Brazil
Hordeum sativum (seed)	Ustilago hordei	Chile, Africa
Houttuyinina cordata	Botrytis cinerea	England
Galanthus elwesii	Penicillium (Hard rot)	Holland
Garcinia mangostana	Diplodia mangostana	Dominican Republic
Ipomoea batatas	Fusarium sp.	Africa
" "	Diplodia tubericola	Mexico
" "	Heterodera radicicola	Bahama
" "	Sphaeronema fimbriatum	Jamaica
" "	Penicillium sp.	Africa
" "	Rhizopus nigricans	Africa
Iris sp.	Botrytis parasitica	France, England
"	Vermicularia liliacearum	France, England
Iris siberica	Botrytis parasitica	England
Iris, Mrs. E. Sanders	Botrytis parasitica	England
Iris, Var. Finali & Balkana	Sclerotium (?)	Holland
Solanum tuberosum	Fusarium sp.	Germany
" "	Rhizoctonia solani	Germany
" "	Actinomyces scabies	Holland (2), Ireland
" "	Botrytis (sclerotium)	Peru
" "	Spongospora subterranea	Poland
" "	Fusarium sp.	Spain
" "	Stysanus stemonites	Spain
Tagua (nuts)	Coremium borzianum	Panama
Triticum aestivum	Tilletia	Africa
Tulipa sp.	Botrytis parasitica	Holland
Tulipa sp.	Botrytis tulipae	Holland
Tulipa sp.	Penicillium sp.	Holland
	PACKING	
Phragmites phragmites	Claviceps microcephala	Holland
Agropyron repens	Puccinia graminis	Geneva, N. Y.
Triticum	Puccinia graminis tritici	Australia
Triticum	Ustilago tritici	Australia

MR. P. A. GLENN: I have often wondered what method of procedure is taken when any of the pests in the list have been intercepted.

What do you mean by interception? That they are found, or excluded.

MR. R. KENT BEATTIE: If a pest is intercepted at the port of first arrival, then the material, unless it can be safeguarded, does not enter the United States. If it is on material against which there is a special quarantine, it cannot enter anyhow, except when the importation is made by the United States Department of Agriculture.

If the material is found by the state inspector at the final destination, the state inspector, we assume, safeguards the material, either by destruction or disinfection, as he may think desirable. If the pest is found by Federal inspectors at Washington, D. C., or at San Francisco, the material is given the very best treatment that we know how to give it to eliminate the pest. If, for example, there is found in certain special permit material an aphis that our inspectors know how to destroy by fumigation, the material immediately receives vacuum fumigation. If a fungus disease is found which we know how to destroy by some treatment, the treatment is given. If we do not know how to destroy the pest, the material is returned to the country of origin or destroyed.

If one of our representatives in the summer field inspection finds a pest, we have the power furnished by special agreement, in every contract issued between the importer of special permit material and the Federal Horticultural Board, to go into that man's nursery and either cause a treatment to be given or to cause destruction, if necessary, of the material concerned. This is not merely based on the quarantine, but on an agreement which the importer has signed and has given us a bond to enforce.

The point to the whole thing is this: the pest must be kept out. At the same time, if it is safe to bring the material in, we wish to help the nurserymen to bring it in, but never at the expense of infesting the country. We have had to destroy very few shipments at the inspection house. For example: One shipment of bulbs which came from Mexico for propagation purposes in this country was so badly infested with an insect that the material was ordered destroyed.

We have, of course, a large force of men in the Bureau of Entomology and the Bureau of Plant Industry, who are experts in insect pests or fungus diseases. Whenever a pest is collected that we do not recognize, it is sent to the experts of these Bureaus for determination. We get all the facts we can. We get immediate determinations because plant material cannot be delayed. It must move.

The stories that you may have heard about the great delays in our inspection house are without foundation. At the time the alleged delays were occurring, it was the expressmen's strike in New York City that made the trouble—and we were, of course, getting the blame.

The facts of the case are that many of the shipments, even large ones, go out of the inspection house the same day they are received, and practically all except the very largest go out by the next day.

There are occasional shipments that cannot be worked in that length of time, but they are always worked promptly. We are handling the shipments by the very best methods that we know. Many nurserymen tell us that the packing we give to the material is far better than that given to it originally in the foreign country. Some of the foreign packing is awful. If we couldn't give better packing than the foreign shipper sometimes does we ought to go out of business.

We are developing some very interesting comparisons between foreign and domestic methods of packing. Some of the nurserymen with the best reputations abroad are the poorest packers, and some with less of a reputation pack better. Some countries pack better than others. We are learning these things, because now propagating material is going through one funnel where the various lots are coming side by side. Instead of assembling the information from forty-eight different groups of inspectors, one group of men now see practically everything in propagating material which enters the country. We are photographing these things and keeping records of them. We are eliminating pests wherever it is possible to eliminate them, and if we can't eliminate them, then the material is excluded.

Mr. R. Kent Beattie: Let me digress and say in closing that in the last year I have had the privilege of meeting with the group of men represented by Mr. Rockwell, in New York City and again in Detroit. There is no group of men in the United States who are more in sympathy with our work as inspectors than these producers of plants. They are not men who are jobbing plants, but they are growing plants and selling them, and I bespeak for Mr. Rockwell the most cordial sympathy of this organization because there is a unanimous feeling among these producers that we are their friends and are doing everything we can to help them and that they wish to co-operate with us. If there are any methods of protection that we can furnish which will help the nurserymen, they want them. They do not want to increase their risks.

CHAIRMAN E. N. CORY: Mr. E. R. SASSCER will give the next paper on the program.

IMPORTANT FOREIGN INSECTS COLLECTED ON IMPORTED NURSERY STOCK IN 1922

By E. R. SASSCER

ABSTRACT

This paper is primarily a summary of the more important insects intercepted on foreign nursery stock arriving in the United States in 1922. A more or less complete list of the insects and plant diseases intercepted on foreign plants and plant products during the calendar year 1922 will be issued in the near future by the Federal Horticultural Board in the form of an Annual Letter of Information. This letter will list the insects by the country of origin, and will also indicate the hosts.

It is obvious from the partial list of insects which follows, that the condition of plants and plant products, as regards insect infestation, has shown little, if any, improvement over past years.

The sorrel Cutworm, *Acronycta rumicis* L., was intercepted on four shipments of fruit and rose stocks from France, and 156 nests of the White Tree Pierid, *Aporia crataegi* L., were taken on shipments of fruit and rose stock arriving from France. As previously indicated[1], literature fails to record this insect as being established in the United States. Also, two shipments of fruit stocks from France bore nests of the Brown Tail Moth, *Euproctis chrysorrhoea* L. *Emphytus cinctus* L., arrived on 26 separate shipments of Manetti stocks as follows: England 8, France 10, Holland 5, Ireland 3, and the Oriental Fruit Moth, *Laspeyresia molesta* Busck, and *L. pomonella* L., were found in shipments of pear from Japan and apple from New Zealand, respectively. The eggs of the European Lackey Moth, *Malacosoma nuestria* L., were intercepted on two shipments of fiuit stocks from France.

White Flies were intercepted on a number of occasions as follows: The Citrus Black Fly, *Aleurocanthus woglumi* Ashby, was intercepted on foliage of plants arriving either as ships' stores or passengers' baggage: Cuba 5, Jamaica 4, Nassau, Bahama Islands 3, on *Citrus* sp., Coffee, Jasmine, Avocado, and *Stephanotus* sp., from Cuba; on Lime, Grapefruit, Mango, and Papaya from Jamaica; and on Sapodilla, Canipe, and spice from Nassau, Bahama Islands. The Woolly White Fly, *Aleurothrixus howardi* (Quaint.), was taken on five occasions on citrus foliage from Cuba and once on banana from Porto Rico; and Cardin's Whitefly, *Aleurodicus cardini* Back, was taken on guava arriving from the same island. *Lithraea caustica* from Chile was infested

[1]Jr. Ec. Ent., Vol. XV, No. 1, p. 120 (1922).

with *Aleuroparadoxus punctatus* Q. and B., and citrus foliage from Cuba was on four occasions infested with *Dialeurodes citrifolii* (Morg.). *Aleurothrixus floccosus* (Maskell) was intercepted on *Citrus* sp. from Porto Rico.

The Sweet Potato Weevil, *Cylas formicarius* (Fab.), was taken on sweet potatoes on 16 occassions—from China 5, Cuba 5, Nassau, Bahama Islands 4, and Haiti 2. The West Indian Sweet Potato Weevil, *Euscepes batatae* Waterhouse, was also taken in sweet potatoes which arrived from Brazil, Trinidad, and twice from Barbados.

Soil which arrived with plants in passengers' baggage was found on two occasions to be infested with larvae of *Agriotes lineatus* L., from Finland and Switzerland, and an unrecognized species of *Agriotes* was found in sand used as packing around dahlia roots from England, as well as a species of *Limonius* in soil about the roots of Scotch heather also from England.

The European Earwig, *Forficula auricularia* L., which in recent years has caused a considerable amount of injury in Seattle, Washington, was discovered in two miscellaneous shipments of bulbs arriving from Holland. It has been felt for many years that this insect gained entry into this country in soil, and in fact, there are instances on record that it can be, and is, carried by soil; however, this appears to be the first record of its arrival with bulbs.

Cocos nucifera from Cuba has been found to be infested with the following Thrips: *Franklinothrips vespiformis* (Crawford), *Haplothrips merrilli* Watson (4), and *Symphothrips punctatus* Hood and Williams; and bananas from Roatan, Honduras were infested with *Metamasius* sp. The Tahiti Coconut Weevil, *Diocalandra taitensis* (Guer.), has also been collected from the former host from Hawaii. Fibre plants from Columbia, arriving in Washington, D. C. were found to carry the workers of *Nasutitermes* sp., a genus which does not occur in the United States, and is considered a destructive wood borer and injurious to plants.

Two large shipments of broom corn arriving from Hungary during the year were found to carry a large number of living larvae of the European Corn Borer, *Pyrausta nubilalis* Hubn. As a condition of entry, this corn was carefully sterilized with live steam, preceded by a vacuum.

Had it not been for the vigilance on the part of an inspector of the Federal Horticultural Board, located at Baltimore, Maryland, it is possible that the Pink Bollworm, *Pectinophora gossypiella* Saund., would

now be established in Mississippi. This one interception revealed some fifty odd packages of cotton lint and seed which bore living larvae, pupae, and adults of the Pink Bollworm. This collection of seed, while very innocent in appearance, would no doubt have resulted in an enormous tax on the part of cotton growers, had it been permitted to reach its ultimate destination.

The following incident illustrates the possibility of introducing the Pink Bollworm in cotton and cotton waste used for packing. A collection of souveniers arriving in New York from St. Kitts was packed with cotton lint which contained seed infested with living larvae of the Pink Bollworm. The package in question was in the possession of a passenger and was intercepted in the course of inspecting passengers' baggage for contraband material. The Pink Bollworm, in addition to the instances referred to above, was collected in cotton seed arriving from the following countries: Brazil 1, Egypt 4, Porto Rico 1, St. Kitts, British West Indies 1. It was also found in cotton bolls from Hawaii.

Even though it was possible to make only a cursory inspection at the port of entry, Narcissus bulbs arriving from Holland were repeatedly found to be infested with the larvae of the Lesser Bulb Fly, *Eumerus strigatus* Fallen. The same type of bulbs from France and Holland were also infested with the Narcissus Fly, *Merodon equestris* Fab. A fairly careful examination of bulbs arriving in Philadelphia revealed an infestation ranging from one to twelve and one-half per cent. The larvae of both insects were present in this shipment. A similar, but smaller shipment of French bulbs (infested with *Merodon equestris* Fab.) which arrived in New York, was examined with equal care, and the results indicated that in five cases examined, the infestation ranged from two to five percent.

Iris rhizomes from England, Holland, and France arrived on a number of occasions infested with *Anuraphis tulipae* Boyer, and roots of this plant from England were also found infested by *Micromyzus tulipaella* (Theo.). The Bulb Mite, *Rhizoglyphus hyacinthi* (Boisd.) was found on a great variety of bulbs; in fact; it is perhaps safe to state that every commerical shipment of bulbs of any size arrives infested with this mite. Injury by this mite has during the past year been reported from Colorado, where it is stated that it caused the loss of an entire crop of lillies. Incidentally, it has also been recorded as injuring smilax and asparagus ferns in Pennsylvania.[2]

Scale insects continue to arrive on plants of various descriptions.

[2]Jr. Ec. Ent., Vol. XV, No. 2, April 1922, p. 179 (Primm).

No attempt will be made to compile a complete list of these interceptions in this paper, only what appear to be the more important ones being listed below. A full list will appear in th Annual Letter of Information which will be issued early in 1923.

DIASPINE SCALES

Insect	*Host*	*Origin*
Aspidiotus orientalis Newst.	*Cocos nucifera* (3)	Nassau, Bahama Is.
" *palmae* Morg. & Ckll.	Camphor leaves	Jamaica
" *persearum* Ckll.	*Cocos nucifera*	Hawaii
" *subsimilis anonae* Houser	Bobug (?)	Nueva Gerona, Isle of Pines
" " " "	*Annona muricata*	Roatan, Honduras
" " " "	" " (2)	Havana, Cuba
" " " "	" *squamosa*	" "
" " " "	" *cherimola*	" "
" " " "	Cuttings of ?	Santiago de Cuba, Cuba
Chrysomphalus scutiformis Ckll.	Banana (13)	Central America
Lepidosaphes albus (Ckll.)	Manihot cuttings	Brazil
" *conchiformis* (Gmel.)	Taura-mume (pear)	Okitsu, Japan
" *ficus* (Sign.)	Fig	Italy
" *mcgregori* Banks	*Cocos nucifera*	Guam
" *perlonga* (Ckll.)	*Baccharis cordifolia*	Argentina
Leucaspis cockerelli (de Charm.)	Palm (2)	Brazil
Morganella longispina (Morg.)	*Nerium oleander* (4)	Bermuda
Odonaspis pencillata (Green)	*Phyllostachys pubescens*	China
Parlatoria calianthina B. & L.	*Crisomelo monica*	Rome, Italy
" " "	Olive	Madrid, Spain
" *pyri* Marl.	*Pyrus baccata* (Crab apple) (Red Fruit)	Chefoo, China
" " "	Dragon-clawed date	" "
Phenacaspis eugeniae (Maskell)	*Cocos nucifera*	Hawaii
" *inday* Banks	" " (2)	"
Pinnaspis buxi (Bouche)	Ornamental palm	Porto Rico
Pseudaonidia articulatus (Morg.)	*Citrus grandis*	Porto Rico
" " "	" *sinensis*	" "
" " "	Mango (4)	Jamaica
" " "	*Coffea robustus*	"
" " "	*Citrus sinensis* (2)	"
" " "	" *nobilis*	"
" " "	*Annona muricata*	"
" " "	Jamaica tangerine budwood	"
" " "	*Citrus* sp.	"
" " "	*Livistona chinensis* seed (2)	"

Pseudaonidia articulatus (Morg.)	"Ackee"	Jamaica
" " "	*Musa* sp. (5)	Central America
" " "	*Acalypha*	Cuba
" " "	*Annona squamosa*	"
" " "	*Caladium* (?)	"
" " "	*Citrus nobilis*	"
" " "	*Citrus sinensis*	"
" " "	*Cocos nucifera*	"
" " "	*Croton* sp.	"
" " "	Mango	"
" " "	Palm	"
" " "	Screw pine	"
" " "	*Citrus aurantifolia*	Barbadoes, B.W.I.
" " "	*Achras sapota*	Bahama Islands
" " "	Canipe	" "
" " "	*Cirtus* sp.	" "
" " "	*Rosa* sp.	" "
" " "	Spice (2)	" "
" " "	*Tamarindus* sp. (3)	" "
" " "	Unknown	" "
" *clavigera* Ckll.	*Hibiscus* sp. (6)	Hawaii
" " "	*Castanea javanica*	"
" *duplex* (Ckll.)	Gumamela-Purple	Philippine Island
" *paeoniae* (Ckll.)	*Azalea Koreense*	Japan
" " "	" *kurume*	"
" " "	"	"
" " "	? plant	"
" *tesserata* (de Charm.)	*Lycidice rhodostegia*	Ceylon
Pseudaonidia trilobitiformis (Green)	*Citrus aurantifolia*	Barbados, B.W.I.
" " " "	" *nobilis* (2)	Japan
" " " "	" *sinensis* (3)	"
" " " "	" sp.	"
Pseudischnaspis alienus (Newst.)	*Annona cherimola*	Cuba
" " "	" *squamosa*	"
" " "	*Rosa* sp.	"
" " "	Unknown	"
" *bowreyi* (Ckll.)	Cherimoya fruit	"
" " "	Mango	"
" " "	Jasmine	"
Targionia hartii (Ckll.)	Barbados red yam	Barbados, B.W.I.
" " "	Yam tubers	Montserrat
" " "	*Dioscorea alata* (2)	India
" *sacchari* Ckll.	*Saccharum officinarum* (2)	Nassau, Bahama Islands
" " "	*Dioscorea* sp. (Yam)	Cuba
" " "	*Saccharum officinarum*	"
" " "	" "	Jamaica

NON-DIASPINE SCALES

Asterolecanium aurem (Bvd.)	Dwarf *Chamaedorea seeds*	Guatemala
" *miliaris* Bvd.	*Bambusaea* sp.	Cuba
" " "	Bamboo	Bermuda
Coccus mangiferae (Green)	*Cinnamomum zeylanicum* (Cinnamon tree)	Jamaica
Coccus viridis (Green)	*Citrus aurantifolia*	Barbados, B.W.I.
" " "	*Achras sapota*	Bahama Islands
Lecanium coryli (Linn.)	*Tilia dasystila fastigiata lacincinata*	Czecho-Slovakia
" " "	Cherry	" "
" *kunoensis* Kuwana ?	*Pyrus baccata* (Crab apple White Fruit)	Chefoo, China
Pseudococcus maritimus (Ehr.)	*Musa* sp. (banana)(8)	Central America
" " "	Pears	New Zealand
Pulvinaria floccifera (Westw.)	Orchids	England
Ripersia palmarum Ehr.	*Cocos nucifera* (12)	Hawaii

SUMMARY OF COUNTRIES AND THE NUMBER OF SPECIES OF INSECTS REPORTED BY STATE AND FEDERAL INSPECTORS DURING THE CALENDAR YEAR 1922

Africa	16	Cook Islands	2
Algeria	2	Costa Rica	14
Argentina	13	Cuba	97
Australia	12	Czecho Slovakia	14
Austria	2	Denmark	4
Azores	9	Dominican Republic	13
Bahamas	34	Dutch Guiana	6
Barbados	12	Ecuador	1
Belgium	5	Egypt	13
Bermuda	26	England	95
Borneo	5	Federated Malay States	1
Brazil	22	Finland	5
British Columbia	9	France	52
British East Africa	2	Germany	40
British Guiana	1	Grand Cayman	2
British Honduras	2	Greece	1
British West Indies	3	Guam	13
Canada	2	Guatemala	24
Canal Zone	3	Haiti	14
Canary Islands	3	Hawaii	78
Central America	21	Holland	60
Ceylon	32	Honduras	7
Chile	11	Hungary	1
China	57	India	17
Colombia	31		

Ireland	11	Samoa	2
Isle of Pines	10	Scandinavia	2
Italy	42	Serbia	1
		Siam	3
Japan	59	Sicily	3
Jamaica	116	South Africa	5
Java	18	South America	2
		Spain	13
Luxemburg	1	Spanish Honduras	10
		St. Kitts	2
Malta	1	Straits Settlements	2
Martinique	5	Sudan	4
Mexico	55	Sweden	6
Morocco	2	Switzerland	5
New Zealand	4		
Nicaragua	6		
Norway	7	Tahiti	3
Nova Scotia	14	Tongatabu Islands	7
		Trinidad	11
Orient	2	Turks Island	3
Palestine	7		
Panama	7	Uruguay	1
Peru	4		
Philippine Islands	32	Venezuela	1
Poland	1	Virgin Islands	6
Porto Rico	26		
Portugal	3	Wales	1

CHAIRMAN E. N. CORY: The next paper will be by Mr. T. J. Headlee.

THE PRESENT STATUS OF THE GIPSY MOTH IN NEW JERSEY

By THOMAS J. HEADLEE, *State Entomologist*

ABSTRACT

The large expenditures for control of gipsy moth, *Porthetria dispar*, have rapidly reduced the infestation, the Federal Government working in co-operation with the State of New Jersey. It is held that extermination is worth the cost, especially if a barrier zone be established in New York State.

The results of the extermination work against the gipsy moth in New Jersey are of such a character that they are deemed worthy presentation to the association.

As stated in previous reports this effort against the gipsy moth is a co-operative one in that it is jointly controlled and financed by the U. S. Bureau of Entomology and the N. J. State Department of Agriculture. Mr. H. A. Ames was only placed in charge of the promptly established

gipsy moth office at Somerville, N. J. Mr. Ames works under the general supervision of Mr. H. L. McIntyre, chief of the U. S. field service against the gipsy moth.

As the work has gone forward definite methods of record keeping have been developed and it has been deemed wise to make up the tabular statement in accordance therewith.

General Area[1]

Year	Funds Federal	State	Private	Amt. Expended for machinery
1920	117,000	112,000	25,000	109,000
1921	125,000	125,000		
1922	125,000	125,000		?

Sq. miles scouted.	Acres of woodland scouted.	Fruit trees examined.	Shade trees examined.	Number of burlap bands.
680	5,463			15,000
1,224	14,165	1,237,000	787,000	10,869
120	5,561			

No. of trees banded with	Tons of lead arsenate used	No. of acres sprayed.	No. of trees sprayed.
20,000	90	2,430	21,318
31,419	89	3,757	22,923

No. of Gipsy Moth Colonies.	No. of Gipsy Moth Egg Masses.
760	33,065
226	909
29	404

Isolated Areas

Year	No. of areas.	Acres of woodland scouted.	No. of colonies.	No. of egg masses.
1920	15		6	40
1921	15	194.5	0	0
1922	6	634.5	0	0

The preceding tables bring out the fact that while the amount of money being used is large the infestation is being rapidly reduced, both as regards number of colonies and number of egg masses. The data for 1922 is, of course, still very incomplete. The fact that with only about ¼ of the territory scouted 404 egg masses have been found, might lead one to conclude that more eggs will be found this year than last. One must, however, take into consideration the fact that much of the scouting in the general area this year has been done along the river banks

[1]Items of funds, machinery, banding, number of trees sprayed and lead arsenate used include the isolated areas as well.

where there is a heavy growth of large hollow trees in cavities of which the egg masses of last year were sheltered from the crews and that much of this growth could not be sprayed because of the feeding of herds of cattle in areas immediately adjacent thereto. This year a campaign of cutting this growth has been undertaken and is rapidly going forward.

Infestation in all outlying areas has been apparently cleaned up, the colonies have dropped from 760 to 226, and the egg masses from over 3,000,000 have been reduced to 909.

It is, of course, not sufficient to pursue a campaign of extermination in areas already known to be infested and territory bordering thereon, but one must make sure that no other infestations are in process of development and equally certain that no new establishments are taking place.

To handle this phase of the work against the gipsy moth a separate scouting crew is maintained and operated by the New Jersey State Department of Agriculture. This crew scouts the supposedly infested sections of the state, other than the territory bordering the infestations, which are being looked over by the co-operative force. It also examines all shipments of incoming plants and products deemed likely to carry gipsy moth.

The value of this supplementary work is shown by finding a year or more ago of one new but slight infestation and the interception of 14 cases of gipsy moth infestation on in-coming nursery stock.

The New Jersey authorities hold that the extermination of the gipsy moth within the state's borders is a good proposition and worth the money it costs even if the New England infestation does slowly move southward but they hold it to be far better business if an end can be put to this movement and a "Thou shalt not pass" line be erected and maintained somewhat on the lines laid down by Dr. Felt in his paper of yesterday. Not only should such a line as that suggested by Dr. Felt be established and maintained but all infestations beyond it should be promply exterminated.

In a meeting held at Albany recently and attended by Canada, New England, New York, New Jersey and United States Department of Agriculture representatives. It was planned:

(1) To exterminate the infestations in New York and New Jersey.

(2) To hem in the New England infestations by a "Thou shalt not pass" line.

(3) Exterminate all infestations that may later be found beyond it.

(4) Push this line toward the sea.

The New Jersey authorities believe that such a procedure is good business and will stand behind such a movement to the extent of their power.

CHAIRMAN E. N. CORY: We will now have a round-table discussion of nursery stock fumigation, led by Mr. G. F. Arnold.

UNIFORMITY OF NURSERY STOCK FUMIGATION REQUIREMENTS

By G. F. ARNOLD, *A. & M. College, Miss.*

ABSTRACT

Recommendations for fumigating nursery stock in the different states vary considerably in the strength of hydrocyanic acid gas to use and the time of exposure necessary. The variations in temperature and humidity throughout the United States would not permit of standard fumigation regulations for the entire country. It would seem desirable for the states in each section (for example, the Southern States) to adopt similar fumigation requirements for each kind of plant to be fumigated. Suggest further experiments to determine the fumigation schedule that could be adopted in each group of states in the country.

The subject of uniformity of fumigation requirements for nursery stock was discussed at a meeting of southern entomologists and nurserymen held in Atlanta last May. The object of this meeting was to agree on a nursery inspection system which might be considered standard for the Southern States. The nurserymen and entomologists present thought that host plants of scale insects should be fumigated as a precautionary measure.

Several of the nurserymen inquired the strength of hydrocyanic acid gas necessary for the different kinds of nursery stock. The entomologists present differed considerably in their opinions on this point. The majority seemed to think that one ounce of sodium cyanide to each one hundred cubic feet of space was sufficient for such stock as dormant apple, plum, pear, quince, cherry, apricot and pecan. In one of the states represented the regulation dosage for dormant pecan stock is one and one-half ounces of sodium cyanide to each one hundred cubic feet of space. This dosage for pecans has been used in that state in fumigating large quantities of pecans for several years past and no injurious results have been reported.

It was brought out at the meeting that the regulations in the Southern States vary considerably in the dosage of cyanide prescribed for tender peach trees, usually termed "June-buds." Several of the entomologists

present stated that an ounce of cyanide to each one hundred cubic feet of space had been used in their states without injurious results. Others present stated that two-thirds of an ounce of cyanide was the dosage for this class of stock in their states. Some of the entomologists present were of the opinion that not more than one-half of an ounce to each one hundred cubic feet should be used for "June-buds," and said this was the dosage used in the states where they were employed.

The discussion about the amount of cyanide to use in fumigating peach stock was especially interesting to me, as the State Plant Board of Mississippi requires the full ounce of cyanide for this class of stock and one of the Alabama nurserymen shipping much peach stock into Mississippi had protested that this large dosage would either kill or seriously injure "June-buds." It seems that he based his opinions on statements made in a letter received from his brother, a fruit nurseryman in Colorado, who informed him that this dosage had injured peach trees fumigated in that state. In answer to an inquiry from me sent out in June relative to this matter, Mr. George M. List, the Colorado Inspector replied as follows:

> "This last spring we carried on a series of tests in fumigating dormant peach trees. This test included a variety of strengths ranging from three-fourths of an ounce of sodium and potassium cyanide to double this amount to each one hundred cubic feet of space. The exposure ranged from forty-five to ninety minutes. This was applied in both wet and dry stock. So far, one hundred percent of the trees are growing nicely in the nursery row."

The entomologists at the Atlanta meeting seemed to be agreed that one-half ounce of cyanide was sufficient for roses. Rose stock is not required to be fumigated in Mississippi except when scale is found on a block of stock to be offered for sale. On several occasions, San Jose Scale has been found on Rugosa roses in Mississippi nurseries, and fumigation with one-half ounce has been required.

The most extreme view to be expressed on fumigation requirements at that meeting was from the representative of the Louisiana Department of Agriculture. He pointed out that they had conducted experiments in New Orleans in co-operation with the United States Bureau of Entomology and had demonstrated that the Japanese Camphor Scale (*Pseudaonidia duplex*) could be controlled with a much lighter dosage than was being used to fumigate with in other states. Experiments showed that three-fourths of an ounce of cyanide to five hundred cubic feet was sufficient for hardy nursery stock while three-fourths of

an ounce to each thousand cubic feet for tender ornamentals was sufficient to kill the Japanese Camphor Scale. Judging by the numerous carefully conducted experiments made by these investigators, the Camphor Scale seems to be killed by as small a dosage as the above. It is my opinion that this small dosage would not be effective on Camphor Scale except under ideal conditions as regards humidity, temperature, tight fumigation house and extreme care on the part of the operator. Nor could such a dosage be expected to be of value against such scales as San Jose Scale (*Aspidiotus perniciosus*), Florida Red Scale (*Aspidiotus ficus*) and Dictyospermum Scale (*Chrysomphalus dictyospermi*). In fact, on several occasions inspectors of the Mississippi Plant Board have found specimens of some of the above scales in shipments of nursery stock from New Orleans accompanied by the special Louisiana certificate of inspection showing the plants to have been fumigated under supervision, and, when examined in the laboratory, the scales had the appearance of being alive.

Several of the nurserymen present at the Atlanta conference expressed the opinion that they could better comply with the fumigation requirements of the states in the South into which they ship nursery stock if the fumigation dosage prescribed was the same in all Southern States. The chairman of the meeting appointed a committee (on which I was included) to investigate this matter and then to recommend a standard fumigation dosage to officials in charge of the plant inspection work in the several Southern States.

In order to learn of the ideas on fumigation held by the plant inspection officials of the country, a questionnaire was mailed to the official in charge in each state. Replies to the questionnaire were received from practically all of the forty-eight states. The information when tabulated was of considerable interest, because it showed that there was much difference of opinion about the fumigation of nursery stock.

Replies indicated that several states in the East and Middle West had practically dispensed with fumigation for nursery stock for the reason that the San Jose Scale had become very scarce in their states. A number of other states recommend fumigation to the nurserymen, but do not make it compulsory except when scale is found in the stock of a nursery. A number of the states specify that all host plants of San Jose Scale should be fumigated as a precautionary measure. Pecan stock is required to be fumigated in a few of the Southern States.

The replies to the questionnaire showed that the dosage used in the

states varies considerably for the same kind of nursery stock. The following formula to the one hundred cubic feet is used by many of the states for dormant stock:

1 Ounce of Sodium Cyanide
2 Fluid Ounces of Sulphuric Acid
4 Fluid Ounces of Water

The amounts of acid and water considered necessary to generate the gas with one ounce of sodium cyanide varies in several states. Only one fluid ounce of sulphuric acid is used in some of the states, one and a half ounces in others, and three ounces in a few states in connection with the one ounce of sodium cyanide. The amount of water used with an ounce of the cyanide is only two fluid ounces in some states and three in others.

It is recommended in most of the states that exposure to the gas be from forty minutes to one hour. Many states consider a thirty minute exposure as ample, while on the other extreme one of the states in the Northwest specifies an exposure to the gas of ninety minutes.

Many of the State Inspection Officials have apparently overlooked the fact that sodium cyanide give one-fourth more gas than potassium cyanide. The fumigation dosages worked out years ago on the basis of potassium cyanide do not seem to have been lowered any by its replacement within recent years by sodium cyanide.

In my opinion, it would not be feasible for all the states in the country to attempt the adoption of a standard fumigation schedule for nursery stock. This is due chiefly to the great differences in humidity and temperature in the different states at the time the plants are fumigated. Experiments conducted by the Federal Horticultural Board at one of the Cotton Fumigation Plants in Boston demonstrate clearly that it is difficult to kill insects by fumigation when the weather is extremely cold. In these experiments Brown-tail moth larvae and European Corn Borers were subjected to a dosage of six ounces of sodium cyanide to the one hundred cubic feet in a vacuum for two hours with the result that at extremely low temperatures some of the larvae were still living at the conclusion of the experiments. Please note that this dosage is several times that ordinarily used for nursery stock, and it would appear doubtful whether nursery stock could survive so much hydrocyanic acid gas.

It would seem that the states in a group where the temperature and humidity conditions were very nearly uniform could adopt uniform fumigation regulations. For example, all Southern States should recom-

mend the same size dosage to nurserymen for the same kind of nursery stock.

One reason why this should be done is to insure all nursery stock shipped being fumigated with a sufficient dosage of gas to kill all the pests. Another reason is that the nurserymen would better comply with the fumigation requirements of the states in a certain group if the fumigation regulations in all were similar.

Some of the state plant inspection officials are of the opinion that dipping nursery stock in a miscible oil or oil emulsion is as effective as fumigation with hydrocyanic acid gas and even more satisfactory. This may be true, providing the dipping is carefully done. Dipping could probably be substituted for fumigation by the small nurserymen better than by the large nurserymen, since it is cheaper to fumigate a large quantity of trees than it is to dip them in a miscible oil or oil emulsion.

After having collected data from the several states on fumigation formulas in use, time required for fumigation and other information, and find that there is so much variation, one naturally hesitates to make any recommendations along the line of standard fumigation requirements for even a group of states. It would seem highly desirable that a number of experiments be conducted in several sections of the United States to determine what fumigation requirements might be considered standard in each group of states in the country.

MR. E. R. SASSCER: I regret very much that we do not have more time to discuss this important problem. It is one which deserves more attention than it is receiving on the part of those requiring the fumigation of nursery stock as a condition of distribution. Mr. Arnold was good enough to permit me to examine the replies he received to a questionnaire, and I was astonished to discover that there are about as many formulae in vogue for the fumigation of nursery stock as we had in the old days for the preparation of lime sulphur and salt. It appears that many entomologists are unaware of the fact that at the request of Doctor Marlatt the United States Bureau of Chemistry worked out a formula which will give the maximum yield of gas from a given amount of cyanide. Information on this subject is given in Bulletin No. 90, Bureau of Entomology, published in 1912. In view of the thorough investigations made by the Bureau of Entomology in California and elsewhere there seems to be little excuse for the development of so many formulae.

Another very important point to be considered in fumigation work is the kind of cyanid used. I venture to say that there are very few entomologists who can indicate off-hand the cyanogen content of Sodium Cyanid satisfactory for fumigation purposes. When recommending the use of Hydrocyanic-Acid Gas to nurserymen, all entomologists should clearly indicate the cyanogen content of the cyanid to be employed, as well as the specific gravity of the Sulphuric Acid. The fact should also be borne in mind that the high grade Sodium Cyanid of today contains approximately one-third more available cyanogen than does high grade potassium.

Another factor which should receive serious thought on the part of officials requiring fumigation is the temperature at the time the work is performed. The effect that low temperatures have on fumigation results was well brought out by Mr. R. I. Smith in his paper which he read yesterday. In view of the results secured by Mr. Smith, I am inclined to believe that much fumigation has taken place in the past at temperatures so low that the gas was ineffective against San Jose Scale and other pests which may be distributed on nursery stock.

Another unfortunate situation which arises, is the inability of state entomologists to be present at the time the plants are fumigated. This work is turned over to the nurseryman, who probably assigns the actual fumigation work to a laborer.

Mr. C. L. Marlatt: In connection with this round table discussion, it might be well for a mmoent to refer again to the proposition Mr. Rockwell presented to the Section. We are all in agreement with the suggestion and it is a matter that has been discussed many times at our meetings. In connection with the original effort to secure national plant legislation, the bill which was drafted some 25 years ago dealt chiefly with the idea of governing the movement interstate, of nursery stock. The foreign features of the bill were almost negligible. It was an effort to get just what Mr. Rockwell has now suggested, national legislation to be enforced in co-operation with the states, to regulate the movement interstate of nursery stock.

The reason we failed to get this legislation 25 years ago was the lack of agreement of the nurserymen and others concerned. It may be advisable to call an interstate conference on the subject, to discuss it fully from the standpoint of the different state needs, and from the standpoint of the nursery interests, as a basis for a new bill to be presented to Congress; and with the support of the states and the other interests such legislation might now be obtained.

It is a big subject and it is a thing that cannot be easily accomplished, but it is one I think that there is no disagreement about.

MR. F. F. ROCKWELL: I have no idea that the problem can be solved here, but I hope a resolution can be adopted showing that you accept the principles mentioned. As Dr. Marlatt has said, there are conflicting interests even among the nurserymen themselves that their own organization will have to try to take care of.

MR. T. J. HEADLEE: I would like to offer a motion in order to get the sentiment of those present.

Resolved, That it is the sense of this Section that a uniform U. S. tag should be required for interstate movement of nursery stock, and that the qualifying inspection should be worked out between the United States Department of Agriculture and the state authorities.

The motion was carried.

MR. T. J. HEADLEE: The motion passed is all right but it is another thing to get the machinery to carry it out. I would therefore move that the chairman be empowered to appoint a committee consisting of a maximum of 5 to see what can be done toward working out this proposition along practical lines.

The motion was carried.

CHAIRMAN E. N. CORY: The chairman, with the approval of President Ruggles, appointed the following members of this committee: T. J. Headlee, Chairman, F. M. O'Byrne, G. M. Bentley, E. C. Cotton and E. R. Sasscer.

We have a committee that was appointed last year to consider the possiblity of greenhouse inspection. Mr. E. R. Sasscer is chairman and I would like to hear from him at this time.

MR. E. R. SASSCER: The committee mentioned was appointed last year. It was unfortunate in a way that the motion provided that the membership should be distributed geographically, This has made it necessary for the committee to depend entirely on correspondence, as it has never been able to meet. . The problem is so complex that it is not possible to make a definite report at this session. I would request that the committee be continued to report next year, if possible.

Upon motion, it was so voted.

CHAIRMAN E. N. CORY: We will now listen to the report of the Nominating Committee.

MR. W. E. BRITTON: The committee recommend for chairman, Mr. P. A. Glenn; for secretary, Mr. E. R. Sasscer.

On motion, the ballot was cast and these officers elected for the ensuing year.

There being no further business, the session adjourned at 1:30 p. m.

Afternoon Session, Friday December 29, 1922

The meeting was called to order by President Sanders at 2:00 p.m.

PRESIDENT J. G. SANDERS: At the last annual meeting of this association, it was voted to hold a symposium on "Standards for the training of men who are to enter professional entomology." The papers will be presented as listed on the program and discussion deferred until after the last paper has been read.

I will now call on Professor Herbert Osborn for the first paper.

STANDARDS FOR THE TRAINING OF MEN WHO ARE TO ENTER PROFESSIONAL ENTOMOLOGY
PERSONAL CONTACT WITH STUDENTS

By HERBERT OSBORN, *Columbus, Ohio*

ABSTRACT

Earlier entomologists presumably had not set standards for training. The problem of standards is worth careful discussion. A great part of our knowledge is gained through personal contact and we lose in proportion as it becomes impossible. The advanced courses permit closer contact; there is also contact later with station and extension workers. Teachers in vocational agriculture frequently have opportunities to discover latent talent. There should be helpful contacts between entomologists and their assistants, partaking of the educational. There is no more ideal training than under the tutelage of a man of large experience. One method of obtaining this is through summer assignments with the Bureau of Entomology or Station Entomologists.

Among the earlier workers in Entomology in America I think we may assume there was no thought of any set standard to be met and State entomologists, museum curators and teachers were employed, where employed at all in a professional capacity, on the basis of their interest in the subject and the proficiency they had shown to others more or less familiar with the requirements of such work.

With an ever increasing demand for competent entomologists and with advancing ideals as to the qualifications necessary for efficient work it is natural to enquire whether it is possible to establish any standards to assist in the selection or recommendation of candidates for the varying demands of different positions. Are such standards as are commonly in use in medicine, law, engineering and other fields available and if so can we adjust our systems of entomological training to meet such standards. It is a question well worth discussion, for the

future progress of our science is closely linked with the quality and training of the men who are preparing to devote their lives to effort in this field.

Whatever we may believe as to the desirability of the standardizing of our entomological training, whether we favor a large freedom in the basic courses or would insist on rigid training in certain technical details that appear important or imperative I presume there will be no great difference of opinion when we consider the personal equation and recognize the place that the teacher must occupy in any scheme of training that may be devised. Not only technical training but personal character must enter into the equipment of a successful professional worker. So I anticipate no very serious opposition in the discussion of my topic in this symposium.

I suppose no argument is necessary to show that a great part of our knowledge is gained by personal contact with some teacher. The biographies of conspicuous figures of all ages prove that they have received their impulse or direction from some more experienced person or that they have in turn been the stimulating force for many followers. Probably every one present looks back to one or a number of teachers who have given the initial impulse or the guiding force in shaping his own career. Other factors may play a large part in individual cases, and we can allow for the exceptional genius who seems to have blazed his own trail in unknown territory but to the great majority the personal approach is a most essential part of our systems of education.

This does not mean that individuals must always be related as teacher and pupil or have this contact under the formal methods of any kind of school. Indeed some most striking cases of inspiration and direction are found entirely outside the halls of learning.

Under our modern conditions of education there is less of opportunity for contact between teacher and pupil especially in all the lower grades of school work, and it seems to me that we have lost proportionately in the personal influence of teacher upon the pupil. Perhaps the most ideal condition for certain phases of education was found in the system of tutor and pupil with practically a personal direction for each individual. This of course restricted the educational effort to the favored few and we cannot regret the change which has given us a greater degree of universal education even if we have lost some of the advantages of the individual training. I once heard a distinguished educator remark that he believed that music was better taught than any other subject because of the individual direction in vogue with that subject. How-

ever that may be, we can appreciate the advantage of the direct contact which enables the teacher to understand the personality of the pupil and to guage his instruction by the ability and interest which he manifests.

In our biological work we have found a great advantage in the use of field courses or summer laboratory courses where, in addition to the direct contact with the subject, we have much more opportunity for the direct relationship between teacher and pupil. I do not think anyone will deny the great advantage from this sort of instruction and it is unfortunate that it cannot be applied to larger numbers of students in High School or the lower classes of College work.

As we come to the more advanced work of College and University classes we have of course opportunity for closer contact between instructors and students but many students who might have been attracted to entomology had they had the proper contacts have missed any such knowledge of the subject as would attract them to it as a career. Considering such students as do come to these higher courses I think we can hardly overstate the desirability of a close and friendly contact between teacher and pupil, and such sympathetic encouragement as will carry the student forward to a full appreciation of the subject.

Independent of the normal class-work there are many avenues through which instruction may reach individuals even if not considered primarily as students. It seems to me that we can emphasize the opportunity for station and extension workers in the students point of view, and to cultivate a far greater acquaintance of our subject. It is very evident that our success in securing the adoption of our control measures, is very dependant upon the ability of the public to understand the measures advocated and in some degree to appreciate the basis for such recommendations as are named. Moreover, the station and extension worker in addition to work with mature individuals is almost certain to have frequent contact with younger persons, perhaps still in the student stage who may be greatly influenced by suggestions and encouragement in the direction of thorough study of entomological problems.

It is in this way that we may hope to recruit promising men for the coming demands in entomology.

The teachers in vocational agriculture also have an opportunity to discover latent talent in such work and may be instrumental in starting pupils on an important career.

Another phase of contact is to be noted between entomological

workers and their assistants or helpers. In the great majority of cases I believe it is only fair to the assistant to count him in part as a student, a man to be encouraged and stimulated with the idea that he is to advance to larger opportunities and greater responsibilities.

I would suggest therefore, that every station and extension worker, or for that matter every entomologist who may find opportunity for contact with interested individuals should think of himself as a teacher and do his utmost to interest and encourage the individual. He can reflect that many of our most useful workers have been discovered in this manner.

Assuming that these general statements may be accepted there is still the practical question as to whether the opportunities for personal contact between the teacher and the entomological student are all that they should be or whether there are opportunities for improvement in our present systems.

I can think of no more ideal plan of training than for an ambitious student with a clear conception of what he wishes to prepare himself to do coming under the tutelage of a man of larger experience and training in the subject, himself alive to the opportunities for growth in his chosen field and ready and willing to impart his knowledge to those who seek it.

In such conditions there is no close figuring on hours to spend or credits to be received but a mutual give and take, in an association of pleasure and of profit to both teacher and student. Imagine if you can such an association as Benjamin D. Walsh with the youthful C. V. Riley debating as to hours and credits or thinking of any limitation but physical barriers of strength and time in their study.

Now there are manifest difficulties in adapting this method in college schedules but somewhere in the training of the entomologist there should be an opportunity for the student to come under the direct guidance and inspiration of the more experienced worker. One of these opportunities is afforded when the student is assigned to summer or vacation work with the Bureau of Entomology or Experiment Station entomologist. The success of the plan is dependent upon the character of the men and in large degree upon the seriousness with which the older worker views his responsibility to the student. Naturally the men responsible for making such connections must use careful judgment in arranging the combinations.

The contacts, possible with advanced students in the college or university have already been suggested. Such contacts naturally in-

creases as the student progresses to special and research courses and the opportunity for stimulating contact may reach its climax in the graduate work in special problems where the instructors personal interest in an investigation may blend with those of his pupil. The value of this contact is unquestioned but in a way it seems regrettable that it comes at a time when the student may be least in need of it. If the budding entomologist has overcome the pitfalls of his earlier educational career he is in a pretty fair way to steer himself through the later processes. The means to reach the potential entomologist in his early years of student life, except for the rare cases where he is already fixed in his purpose to prepare for this profession are not clear. I can suggest nothing better than that biological teachers strive to present their subject in such manner as to stimulate the latent interest of the student and be alert to recognize and encourage talent whenever it appears.

It must be very manifest that I have only touched upon certain phases of this subject which might be indefinitely expanded but I trust some of the suggestions may find their place with other topics of this symposium and possibly help in an appreciation of the problems to be met in the preparation of entomological workers.

THE NEED OF CHEMISTRY FOR THE STUDENT OF ENTOMOLOGY

By William Moore

Abstract

The economic entomologist should be well grounded in chemistry, especially organic and physical chemistry for the purpose of enabling him to see and solve the problems in connection with the use of insecticides.

Introduction

The economic entomologist justifies his work and makes his claim for federal and state funds upon his ability to make sound recommendations for the control of various insect pests. Altho parasites may hold in check certain insects and the damage from others may be reduced by proper cultural methods, the burden of control rests upon the use of insecticides. Progress in the development of insecticides and a knowledge of their action has not kept pace with the development of other phases of economic entomology. The failure of the entomologist to make greater progress in the development and use of insecticides is no doubt due to his lack of chemical knowledge. The chemical training of the entomologist in the past has been so meager that he makes and

recommends mixtures of insecticides and fungicides which are not only incompatible but even useless and in many cases harmful to the plant. One could easily offer an excellent argument, showing the need of more chemical training in the course of study of the young entomologist, by presenting a series of quotations from the writings of current entomologists. Such a paper might not meet with hearty approval. I shall therefore try to outline some of the problems and difficulties encountered in the use of insecticides and permit you to judge whether the economic entomologist has sufficient chemical knowledge to solve them.

Physical Variations in Insecticides

Solutions of electrolytes and non electrolytes, colloidal solutions, emulsions, and suspensions are all represented among the common liquid insecticides. The effectiveness of the spray often depends upon its physical rather than its chemical nature. Emulsions are often more effective than solutions, and even the character of the emulsion has an influence. Emulsions with very small particles will behave differently from one with large particles. Recently an oil company has prepared an oil which mixed with water forms a system with particles so small that it may be classed as a colloidal solution or emulsoid. The water can be evaporated from this colloidal solution without destroying the original properties of the oil. Lime may even be added to the solution and the oil will not collect in a film on the surface until several hours have elapsed.

An emulsion of water in oil can easily be made and might be a far more effective insecticide than the ordinary emulsion in which the oil is the disperse phase. No one to my knowledge has ever tested such an emulsion to determine its effect on insects or plants.

Recently it has been shown that by the use of a protective colloid, in the manufacture of lead arsenate, a more finely divided material could be prepared. The reduction of the size of the particles should increase their solubility and possibly their toxicity but may not the presence of the protective colloid more than neutralize this advantage?

If a soluble salt is present in a suspension of a slightly soluble arsenical, having an ion in common with it, the solubility of the arsenical will be reduced. Such a salt may be present at the time the arsenical is tested for water soluble arsenic with the result that little or no soluble arsenic will be found. After the spray is applied to the foliage the soluble salt may be washed away by rains or dews or may be changed to a less soluble form with the result that the plant is severely burned.

The smaller particles in a dispersion of a slightly soluble material upon standing will grow smaller while the larger particles will grow larger. If the material is a solid there will be difficulties in keeping it in suspension, if an oil, the emulsion will break.

The particles in a suspension may carry a positive, a negative, or no electric charge. The character of the charge frequently controls the adherence of the particles to the sprayed plant.

Surface tension determines whether the arsenical spray will form a thin film over the leaf surface or roll off in the form of drops. It also largely determines the effectiveness of the contact spray and the cattle dip.

The phenomenon of adsorption plays an important role in limiting the value of soil insecticides, nicotine dusts, and certain fumigants. There appear to be several types of adsorption and it is only by a thorough knowledge of this phenomenon that its effect may be overcome.

Two compounds of the same composition may be optically active or inactive. It has been shown that, of the optically active compounds, the laevo rotatory are more toxic to both animals and plants than the dextro rotatory. To what extent has this physical property been considered in the use of insecticides.?

Chemical Reactions of Insecticides

In order that the cost of application be reduced entomologists frequently recommend the combination of two or more insecticides and fungicides. Some of these mixutres are made without regard to the incompatibility of the materials or the chemical reactions which may reduce their efficacy. Such an incompatible mixture as lead arsenate, lime sulphur, nicotine sulphate, and soap has been recommended. In other cases lime is added to lead arsenate in such large quantities as to almost entirely destroy its insecticide value. Lime sulphur is used with lead arsenate without regard to the many and complicated chemical reactions which occur. In these days when dry mixtures of lead arsenate, lime, sulphur, and calcium caseinate are coming to the front, the question of the reactions between these ingredients should be carefully considered. When mixed and stored for a short time in a tight container one series of chemical reactions occur, while if stored in the open an entirely different series of reactions take place. In neither case would the final product be similar to the freshly prepared material.

It is not generally recognized that lead arsenate and calcium arsenate are fundamentaly different and that the conditions favorable for the

use of the one are unfavorable for the use of the other. Bordeaux mixture will have more influence on the toxicity of lead arsenate than of calcium arsenate.

The arsenic usually classed as water soluble may be in the form of a very soluble or a slightly soluble compound. It may even be colloidal. These differences are generally ignored but are important since they influence the amount of injury to the foliage.

The value of lime sulphur in the control of scale insects has recently been questioned. Certain chemical reactions produce calcium polysulphide while a different series of reactions result in its decomposition. By having conditions favorable for the formation of the polysulphide and unfavorable for its decomposition, good lime sulphur may be made without the use of heat. Under similar conditions the sulphur may be kept in the form of a polysuphide for longer periods of time than is possible with ordinary lime sulphur. May not such a preparation have greater insecticidal value?

Slight and what may appear trivial differences in the chemical constitution of the insecticide may cause decidedly different results. A potassium soap may be more injurious to foliage than a sodium soap altho made from the same oil and having the same alkalinity and the same water and glycerine content. How often do we see the recommendation of soap without any specification as to its composition?

In cattle dips the mere change from the arsenite to the arsenate is accompanied by a change in its insecticidal value altho the same amount of arsenic is still present in solution.

Even the arrangement of the groups in the molecule of an organic compound may make a great difference in its effects. M-nitro-p-toluidine is slightly more injurious to bean foliage than p-nitro-o-toluidine, but the latter compound is more toxic to *Epilachna borealis* Fab. Both of these chemicals have the same groups, differing only in the position of the radicals in the benzene ring.

Conclusion

These few problems picked at random from the field of insecticides will serve to show that the economic entomologist should be well grounded in chemistry. Having completed the general courses in physics and chemistry what further work should the student of economic entomology take in the limited time available for these subjects? It should be borne in mind that the object sought is, not the making of a chemist but rather, the production of an entomologist with sufficient

knowledge of chemistry to see and to be able to solve the chemical problems which confront him in the use of insecticides. Co-operation between the entomological and chemical departments of our universities should make it possible for the student of entomology to obtain such a knowledge without spending considerable time in courses essential to the chemist but not so necessary to the entomologist. Analytic chemistry is such a course. It is more essential for the entomologist to have a knowledge of organic and physical chemistry than to be able to make qualitative and quantitative chemical analyses. Among the organic chemicals there are doubtless many new and important insecticides awaiting discovery. Insecticides are applied in the form of emulsions, suspensions, and dusts, hence a knowledge of physical chemistry particularly that portion which treats "of bubbles, drops, grains, filaments, and films" generally known as colloid chemistry is most essential.

THE ENTOMOLOGIST AND THE PUBLIC

By W. C. O'Kane, *Durham, N. H.*

ABSTRACT

Every entomologist comes into relation with the public. It is worth while recognizing this fact and turning it to good account. Bulletins, circulars and popular articles afford the widest contacts. Essentials for these are a ready command of vigorous English, a logical arrangement of material in bulletin or circular, the use of a summary, condensation and simplification of matter in popular publications, the use of readable type face, the employment of good illustrations, either photographs or line drawings, and attractive typography in general. Personal letters of inquiry should receive personal, direct answer. The county farm bureau and county agricultural agent can increase the value of the contacts and influence of the entomologist. Popular addresses, to be effective, require honest and adequate preparation. All of these things are worth while because they help to make the entomologist a useful servant of the public and a worthy representative of his science.

Every entomologist, at some point in his work, bears some relation to the public, whether that public be the wide and miscellaneous people at large, or whether it be a more limited group, specifically interested in his work. I can think of no exception to this rule.

Even the specialist, engaged in pure research, has occasion to make contacts, not only with other men engaged in the same science but with those who are interested only indirectly. He has letters to write, materials to discuss and papers to prepare. Not infrequently his reports are read by men who have no technical knowledge of his subject. He cannot, if he would, avoid these relationships.

For most of us contacts with broader groups are of daily occurrence and inevitable. We have a miscellaneous mass of correspondence to handle, publications to prepare for the layman as well as for the scientific reader, meetings to address, wherein the audience may know little about our subject matter. We are in contact daily with this or that person to whom our training and knowledge mean the opportunity to seek information or help. It is a characteristic of our profession, as it is of that of the physician. It carries with it an obligation that is at the same time a privilege.

The widest contacts made by the entomologist presumably are secured through the printed word: through bulletins, circulars and articles in the popular press. It should require no proof to demonstrate that for these contacts the first and vital essential is a definite, ready and workable command of English. Entomology is not alone in this requirement. It prevails, I am convinced, through all of the tasks that the college-bred man of today, whatever his calling, may undertake. Its possession is an equipment of definite, undeniable value which will facilitate his work, make it more effective and give him pleasure in its use. It is and should be fundamental in college courses. But its acquirement is not a matter of classroom alone. It is to be attained and strengthened only through diligent, thoughtful exercise, backed up by a lively interest and a sure appreciation of its worth.

You may say that this possession is unnecessary in the work of the man who is engaged solely in research. It is perhaps unnecessary in the sense that the given task of research may be carried on without it. But there could be no manner of doubt that with its help even the research specialist will strengthen at least some phase of his task.

I recall at the moment a technical bulletin that I read two or three years ago, describing the result of a long series of studies. It was a work of importance, broadly fundamental to the science of entomology and of interest not only to all who are engaged in that science but to the workers in other branches of biology, in chemistry and in physics. There was solid substance there. But it was so involved in the telling that its value was hidden rather than disclosed and its precise meaning made uncertain in some of its aspects. It was an excellent example of the unconscious art of obscuring valuable thought by valueless words.

In contrast my mind reverts to a brief paper read before our Association three or four years ago by one of the founders of Economic Entomology. The facts described in the paper were so clearly and so graphically expressed that one grasped them instantly and without

effort. This Association sat intent while the paper was read. The man who presented it has had a profound influence in the development of Entomology. A measurable part of that influence can be traced to the facility of expression which he trained his mind and his pen to follow. His books and his many printed papers bear witness, page by page, to the value of clear, vigorous English.

In emphasizing, thus, the worth of a command of English I would not be misunderstood as pleading for elaborate rhetoric or a familiarity with long words. Quite the contrary. Good English does not mean resounding phrases. It means only vigorous, direct, well-chosen expression, grammatically correct, of course, but above all clear and understandable. The documents in the English tongue that have stood longest and gone furthest have not been written in long sentences or many-syllabled words.

The arrangement of material in a bulletin or any other piece of printed matter is foundational. This is the framework on which the report is built. The skilful artisan plans his framework in advance of starting construction. He draws up his outline, determines what shall be the principal divisions of his report, what relation they shall bear to one another, what portion of the whole he shall devote to each. Then, and not till then, he sets about writing. Thus he produces a document that is logical in its structure, that begins at the beginning and ends at the ending, that gives you first the things that you should know first, and last the things that require prior knowledge for their understanding.

In any bulletin or report, except the very brief circular, a summary fills a well-marked need. Conceivably, it is difficult to condense into a summary of half a page or a page the many facts and records, exceptions and qualifications, surmises and conclusions, that go to make up the whole document. Nevertheless, a summary there should be, printed in a different style of type from the body of the document, in order that it may be quickly and readily laid hold of, and giving essentially the major conclusions of the paper.

Such a summary ought seldom to exceed one page in length. If it goes beyond that it tends to defeat its own purpose. It will be the more useful if each paragraph of it indicates the page number in the bulletin where the full discussion covered by that paragraph may be found.

The permissable length of a circular or popular bulletin, intended for the general public, is often exceeded. I am convinced that anything

beyond four pages is seldom read from beginning to end, unless the man who receives it is directly interested in that particular subject or has specifically asked for a copy of the document in question. In the field of motion pictures the willingness of the public to read printed words has long since been studied and determined. A title of a certain number of words is allowable, but a title of double that number is forbidden, even though there be plenty of room on the screen for another sentence or paragraph. The public will fail to read it all in the length of time available; and, having failed to read, will miss the significance of the scene that follows. So in a popular circular it is idle to disregard the willingness of the public to read. I seriously question whether a circular of four pages is actually read by a considerable percentage of those who receive it. Their time is short, or they think it is, which amounts to the same thing.

By a similar principle a type face that is too small repels rather than invites. Many circulars are printed in 7-point type and thereby fail to reach their readers, where 9-point or 10-point would invite attention. If the text is of such length that larger type face is impossible, the remedy lies in condensation of the text rather than resort to smaller type. Nine-tenths of the circulars that we write we can condense, if we are compelled to. Most of them would be improved in the process.

The importance of good illustrations is self-evident. This applies usually quite as much to the technical bulletin or report as to the popular circular, though, of course, the purpose of the illustrations and, therefore, their choice and treatment, may be quite different. Both the photographic print and the drawing should be utilized. Usually the purpose that is well served by the one is not so well promoted by the other. Both are needed. It follows from this that the entomologist should be trained in the making of drawings and in the taking of pictures. In his later work he may come to depend on others to perform both of these tasks for him. But he ought to know how they are done.

So far as the camera is concerned, it is likely that he will never wholly depend on others, for the reason that opportunity will arise to secure photographs of much value in his work if he habitually carries a camera with him and knows how to use it. In these days, efficient cameras are readily obtainable. The mechanical equipment is excellent. Plates and films are now made with wide latitude of exposure and with color values far better than those of a few years ago. Camera shutters are more accurate. In a word, the mechanical and physical equipment is far and away superior to that of ten years ago. The entomologist ought

to be able to use this knowledge and equipment and to make good photographs.

He does not always exhibit such knowledge. Every month circulars or bulletins appear carrying half-tone illustrations that show poorly timed negatives and a mediocre arrangement of subject. Backgrounds are muddy. Important features are out of focus or out of position. In contrast to these some of our entomologists are producing bulletins and reports that carry splendid illustrations, which amplify and illuminate the subject matter. Such bulletins are worth studying.

In spite of creditable material furnished by the entomologist, the printer may do his work so poorly that the effort of the entomologist to produce an effective publication comes to naught. If this is the case, it may easily be possible that the writer of a bulletin can tackle the problem by conference with the printer, by eliminating half-tones from text matter and substituting line drawings in such location, by confining photographic illustrations to an insert plate or two, and by similar methods.

Many entomologists receive large numbers of letters seeking information and advice. They constitute an important avenue of contact with the public. I am one of those who hold to it that a personal inquiry should have some sort of personal answer. It may be that the substance of the answer will be embodied in a circular mailed to the inquirer. But a typewritten and signed reply, even if only a line or two in length, is worth while, because it inevitably helps the man who wrote the inquiry to appreciate, to understand and to utilize the information that is sent him A printed form may convey all the essentials so far as necessary information is concerned. But to the average man such a form is inadequate and leaves with him a feeling that the entomologist to whom he wrote gave insufficient thought to his inquiry. The letter need not be long. Nor need it be the formal document that we are apt to make it. Let it be as if you were replying by word of mouth to a spoken inquiry, and you will carry your point the more readily.

Through the County Farm Bureaus and County Agricultural Agents, the entomologist may often increase the value and extent of his contacts and his influence. These county workers, with others who are engaged in extension activities, can serve important ends for many entomologists. They can assist in spreading information and in getting it utilized. Their direct contacts with farmers, fruit growers and gardeners can help the entomologist to a clearer comprehension of the

problems in his jurisdiction and thus serve as both a guide and a check in his investigational duties. Few men, except possibly certain research specialists, can afford to shut themselves up in a laboratory or can expect to maintain a broad and responsive viewpoint if they fail to seek contacts outside. And I am not sure that the specialist can afford isolation.

In the spoken word the entomologist has at his disposal the influence of direct appeal to a large group whose response he can influence. Those of us who have occasion to utilize this avenue will do well to give time and effort to adequate preparation.

I am reminded of the methods pursued by a close personal friend who speaks every week to two thousand or more people in Carnegie Hall, New York. This man is an able, convincing speaker, one of the best-known and most influential in our country. He is famous for the graphic directness of his address, for his ready choice of words, for ease, simplicity and the earnestness of his appeal. He speaks without any notes. Yet I happen to know that every address that he makes is prepared with assiduous care. The greater part of it is written out in longhand. The ready phrases are turned over and examined, studied and determined in advance. The address as you hear it from the platform represents prolonged and painstaking effort. There is not time to do this, you say. Well, this man, to whom I refer, carries a multitude of other duties, double or treble what you or I are accustomed to perform.

When an address is to be illustrated with lantern slides, I think that even more thorough preparation is necessary, if it is to move smoothly and without distraction. Personally, I know of only one way to accomplish this, and that is by writing it all out beforehand, arranging the slides so that they come smoothly in the proper place, without halting or indecision, and then either reading the paper as it has been written or so familiarizing oneself with it that its arrangement and the substance of it will remain in mind. By this I do not mean the committing of it, word for word. That may be both unnecessary and inadvisable. But I do mean that one should become thoroughly familiar with both the arrangement and the subject matter that is to be presented.

All of these things, the study of English, the thoughtful arrangement of material in bulletins and circulars, the preparation of good illustrations whether drawings or photographs, careful attention to makeup and printing, the willingness to answer personal letters with personal replies, the thorough preparation of material for addresses,—all of these things

mean serious effort and a minute attention to detail. But they will help to make the entomologist a useful servant of the public and a worthy representative of his science. And after all, to be a worthy scientist and at the same time a helpful servant is one of the durable satisfactions of life.

COURSES FOR THE POST-GRADUATE STUDENT OF ENTOMOLOGY

By E. D. BALL

ABSTRACT

The ideal training for the future entomologist would be a broad and comprehensive undergraduate course with special emphasis on the fundamental sciences, followed by a year of specialized training in research, two or three years of assistantship under an inspiring leader, preferably a different one from that under which the graduate work was taken, and then enrollment in some other standard graduate institution for contact with another group of inspiring men, and the completion of his doctorate. The most important single factor in this program is the contact with the inspirational leader. The value of contact with such leadership is not limited to the educational period but is of continuing value throughout life.

The primary consideration of all training is to give the student the best possible equipment for his life work, and in this respect there is no measurable difference between undergraduate and graduate training. The difference lies rather in the objective sought.

In a broad generalization the under-graduate course could be called educational; the graduate work technical, but the fundamental difference is deeper than that and becoming increasingly important with the growth of the science.

The *first fundamental* of graduate training is breadth of knowledge and vision. The entomological field is becoming so broad and complex in its inter-relations with other sciences that it is impossible for a student to properly equip himself for satisfactory work in any phase within the confines of an undergraduate course.

The relationship of insects to human disease requires a knowledge of the broader aspects of the fields of preventative medicine, and sanitation. Their relationship to a large number of animal diseases broadens the field still further, while the rapidly developing relationship to plant diseases brings into greater prominence broader factors in plant physiology, pathology, and nutrition.

A broad knowledge of bacteriology, infection, and immunity is essential to any serious study of the control of insect-borne diseases on the

one hand, or the encouragement of insect-destroying diseases, on the other.

Any serious study of distribution or life histories involves factors of evolution and adaptation of both plants and animals, their ecological inter-relationships and probable trends of modification. This involves familiarity with the fundamentals of geology, soils, and climate, and their relative influence upon the complex under consideration.

The factors of attraction and repulsion in the ingredients of the various insecticides and fungicides used both direct and indirect, as brought out by Dr. Moore, call for a broad knowledge of chemistry, physics and physiology of both plants and animals.

The successful entomological worker of the future will therefore have an adequate undergraduate and post-graduate training, and that training will consist of introduction to the fundamentals of a large number of fields of knowledge, such as chemistry, physics, botany, zoology, physiology, geology, bacteriology, genetics, plant pathology, and entomology in the sciences, and economics, sociology, mathematics, history and languages in related fields, a knowledge of the fundamentals of nearly all the fields being more valuable than a more extended acquaintance with a smaller number.

The *second fundamental* in post-graduate work is to furnish adequate training in the methods of research. Theoretically this is the end sought; practically, it is more in the nature of a try-out to see if the individual possesses that almost intangible and indefinable something that makes for success in research. We owe it to our science to discover any tiny spark of that ability latent in the available material; watch over it, encourage it, and when found, fan it into a flame that will assist in dispelling the darkness of ignorance and in revealing the new pathways for human progress.

The *third essential* to graduate training, and in many respects the most important one, is to bring the student into contact with strong minds, men of inspiration, of vision, and of leadership. If we will consider for a minute the influence wielded on the future of science, through the inspiration of other workers, by a Pasteur or an Agassiz, or in more recent years by a Comstock, an Osborn, or a Fernald, we will thereafter in selecting courses for the graduate student, give more attention to the man than the subject. The inspiration, enthusiasm, and the point of view of a great man are worth far more than any relative merit of individual subjects.

In summarizing, there are three essentials to adequate graduate training:

(1) A broad knowledge of methods and fundamentals in many fields of human endeavor;

(2) A training in research; and

(3) Contact with men of inspiration and vision.

The ideal training would be to have an undergraduate course devoted almost entirely to laying a broad foundation. From a group of such students, those that show exceptional capacity could then be encouraged to take up the graduate work, the first year of which would be largely in training and testing of ability in research. If this proved satisfactory, encouragement should then be given to go on into still more extended endeavors in the research field and into contact with inspiring workers in other fields.

No one department can offer adequate graduate training. Graduate institutions are made up of many departments from which the student must select the best equipment for his chosen field.

Educational policy swings like that of a pendulum. In times past graduate training was considered to be little more than an increased amount of general education; then the pendulum swung the other way and it became too technical and specialized; in fact, the pendulum swung so far that specialization was carried to such an extent in the undergraduate courses as to almost ruin the student with a superficial specialization on a totally inadequate foundation.

We have as yet only partially recovered from this educational orgy; therefore in the present time, if a student who has carried specialization to extreme in the undergraduate course presents himself for graduate work, it is absolutely essential that the error be corrected, and that his graduate work largely make up for deficiencies in his breadth of training. With the best of efforts he can never be as well equipped as the one who took his broad training in the fundamentals first and brought that knowledge and breadth of viewpoint to his specialization, but he can be immeasurably helped.

The ideal training for the future entomologist would be a broad and comprehensive undergraduate course, a year of specialized training in research, two or three years of assistantship under an inspiring leader, preferably a different one from the one under which the graduate work was taken, and then enrollment in some other standard graduate institution for contact with another group of inspiring men and the completion of his doctorate. The major portion of the burden of his re-

search training will already have been completed. He will now be in position to appreciate breadth of vision and inspiration in other fields.

Above all things, let us not in our desire to build up large numbers in our own courses and in our own departments stand in the way of the proper breadth of equipment of the men on whom the future development of American entomology rests.

Research in entomology has developed so enormously that there is no possibility of any one worker covering the entire field of knowledge, or any reason why he should try. Every student should, for example, have some fundamental work in entomological classification and for many lines a rather detailed excursion into the classification of one or two orders will be beneficial, but unless trained to be a museum assistant, the mastery of the entire classification would be a burden rather than a help—an encyclopedia rather than a text. Even if the student was training to be a systematist, an excursion into systematic work in other orders of the animal kingdom, and especially into the modern concept of bacterial and fungoid relationships would be much more helpful. Half of the time otherwise spent in this work could be employed with more profit in the broad fields of evolution, genetics and ecology or in even more distant fields where contact could be made with inspiring men.

There is in my concept no possibility of laying out a postgraduate course for an individual unless you have first laid out the individual, that is, ascertained his aims, ambitions, and capacities. Stop for just a minute to consider the inspiration to zoological science of a man like Agassiz, not only in his generation but continuing down until the present to such an extent that today you can almost tell by listening to a man for a few minutes whether he was a student of Agassiz or even a student of one who was. The fundamental thing is to get inspiration into graduate work. Graduate training is not instruction, but inspiration,—training to think—to think clearly—and then, as Professor O'Kane suggests, he may be able to write clearly.

EXTRA-ENTOMOLOGICAL STUDIES FOR THE YOUNG ENTOMOLOGIST

By Vernon Kellogg, *Washington, D. C.*

Abstract

The more widely informed and the more soundly and broadly educated, the better the entomologist and the more effective he will be. The working economic entomologist should have some basic training in general zoology and botany, systematic

morphological and physiological. He should know something about chemistry. He should be able to read French and German. He should be able to speak and write good English.

General zoologists seem to pay little attention to insects. That is no reason why entomologists should pay no attention to general zoology. Insects are but animals and, considered even more broadly, but organisms. There are fundamental principles of biology that apply to all organisms, to all life. These fundamental principles should be known to entomologists. They can then be specially applied to insects.

Teachers of young entomologists should see that their students get all the general education they can compatible with the time needed for special training in entomology. Modern science, taking its cue from Pasteur, is breaking down the artificial barriers set up between such special fields as biology and chemistry, zoology and botany, zoology and entomology. A man may be a specialist in entomology, but yet not totally ignorant of other fields of science. Let us make our future entomologists broad and sound scientific men.

I want to thank you for giving me the last place this afternoon in this symposium because you leave to me the very simple function of gathering together and knotting the threads of discourse from the speakers that have preceded me.

You have had presented to you most of the important angles—probably you would have had all of them if Dr. Howard had replaced the absent Dr. Quaintance and if Dr. Riley had been here—from which the subject of our symposium could be approached. You have heard already of the major things that you need to have called to your attention specifically, so I have the function, as I have already suggested, of simply trying to point out the general significance of all of that we have heard.

That significance is as apparent to you as it is to me; it is, that we want and that we need soundly educated men and women to be teachers or students or workers in entomology. The more widely informed, the more broadly educated, the better the entomologist, and the more effective the entomologist will be.

I could have approached my discussion this afternoon with a little more confidence if there had not been keenly brought to me very recently, some of the consequences of my detachment from entomology in the last few years. The consequences of that detachment were brought clearly to my attention last night when speaking at a little gathering of the friends of Mrs. Comstock, the master of ceremonies, Dr. Weed, introduced me as that "late entomologist, Dr. Kellogg."

In the days when I was a live—or at least a living—entomologist, I received a letter from Dr. Howard, which made me very proud. I still remember that letter today. This letter contained a sentence

which read something like this: "We are glad to find here in the Bureau that the young men who come to us from your laboratory seem to have a sound scientific training." That was what I conducted the laboratory at Stanford for—to try to give sound scientific training to students in entomology.

I know I required my students, very often against their will, to take courses in general zoology and invertebrate zoology and embryology and general botany and plant pathology and mycology, and they had to do all these things before they could graduate from the department of entomology.

And it has been my good fortune in these late and declining years, or this period after my decease as an entomologist, to find that some of my students have stood up rather well as broadly educated and soundly grounded workers. That I believe is the goal we ought to try to reach by our education of young entomologists.

The extra-entomological studies that these men or women may take do not need definitions. They can be comprised in a general form by simply saying: Let us give them all the education that we can, compatible with the time which they should devote to their special undergraduate work in entomology. Their graduate work will go on, as long as they live; they will always be learning. We want them to learn in those extra-entomological studies or groups of studies to recognize that insects are but animals and finally, that animals are but living organisms, and that there are great principles and facts which concern all organisms. These the entomologist ought to know if he is going best to understand insects.

I have always been rather astonished and often grieved at the curious indisposition of general zoologists to pay attention to insects. Heaven knows, when they come to count up the animals that they have to do with, they will learn that the insects occupy, with regard to numbers, a major part of the great kingdom of animals. But over and over again, I have noted the courses in general zoology to be singularly deficient in reference to insects. If the course happens to be given in Kansas, they go in particularly strongly for the sea anemones and star fishes!

I remember that my teacher of zoology in the University of Kansas got leave of absence to go to the Pacific Coast, and there he ravaged the coast for miles and practically removed all the marine fauna from this coast, put it into barrels which he brought back, and for the rest of my college career I was pegging away on these pickled sea anemones. As a matter of fact Kansas had always ready for him and us plenty of insects to study, especially grasshoppers and chinch-bugs. But I will

also say that too many entomologists want to pay no attention to anything that is not a bug.

It is true that within the group of insects alone you can find brilliant examples illustrating all the major principles of evolution. Nowhere are there such striking examples of adaptations, variations, and those gradatory series of species that spell evolution to anyone who looks at them. All of these conditions of animal life are splendidly illustrated in insects. Perhaps influenced by twenty-five or thirty years of association with insects, I believe that more basic principles of evolution are beautifully illustrated among insects than in any other group of animals.

But I did not hesitate, especially in my undergraduate years and graduate years, to try always to realize that if I shut myself up alone with my insects I was going to miss knowing something about them that I could find out by looking elsewhere at other forms of life.

I got this first broadening glimpse when I went to work with Prof. Comstock, because he was using insects as illustrations of great principles of evolution. And then I got even perhaps a more broadening view of what one could do in the way of studying insects, when I went to the University of Leipzig and worked with famous old Professor Leuckart there. He was perhaps the greatest parasitologist that ever lived, and insects to him meant parasites; but there were so many insects that were parasites that he always, in his great courses of comparative anatomy and general zoology, gave insects their due place, although always in relation to the rest of animal life and even of plant life. And when one says plant life, that brings a suggestion with a special significance to this group of economic entomologists, because so much of your work is the attempt to save useful plants from injury by insects. And how are you going to do this soundly without knowing something about the habits and the anatomy and the growth and life history of these plants that you are trying to save? You are not going to do it simply by knowing the insects alone.

Mr. Moore has just called your attention to the advantages, aye, the necessity, of having, on your part, some knowledge of chemistry if you are to be effective economic entomologists. And that brings clearly to me just now something that was impressed on me two or three days ago when I helped to celebrate the Pasteur Centenary Celebration in Philadelphia.

Pasteur did the great things he did in biology because he also did great things in chemistry. We are not, most of us, going to be Pasteurs, but we can take a leaf from his book and analyze his method of work. He

was a man who paid no attention to these artificial distinctions that we set up among the different fields of science. He was celebrated almost equally as physicist, as chemist, as biologist, as a man of medicine, and a great contributor to animal and plant industry. He stepped through and across these artificial barriers. Not that he knew all of chemistry, nor all of physics, or all of biology, but he struggled to learn as much as he could of nature and of science, without regard to where this struggle led him, whether toward chemistry or biology or what not, in order to solve the problems in science that were proposed to him.

These problems were given to him, as your problems are given to you, by the conditions in the country in which he lived. The French had a great wine industry, and it was threatened with disaster; and so Pasteur went to work to try to save the wine industry, and in connection with that he made his world famous and lasting discovery of the causes of fermentation —the microbic causes.

When he finished that work, other countrymen of his called upon him to save another great French industry—the silk growing industry. Although he remonstrated that he had not touched a silk worm, and hardly knew one by sight, yet he did not hesitate, with his method and mind and good training, to attempt to discover the secrets of the diseases of the silk worm. And it was he who discovered the actual causes of pebrine, and devised effective remedies for this disease. He saved the French silk industry and that of the world.

Then he was called upon by the cattle and sheep growers, because their herds and flocks were being lost by *charbon*, or anthrax, and he studied the secrets of this and found that the bacillus of anthrax was the cause of the disease, and he also discovered that by attenuating a virus until it becomes a vaccine, and then inoculating the animals with this vaccine, he could immunize the animals from the effects of the disease.

Finally, Pasteur went on to the study of a human disease—that terrible disease of rabies—and he not only discovered its secrets and learned how to prevent its ravages but also founded the microbic doctrine of infectious human disease.

Well, there is an example for the entomologist. You and I can never be Pasteurs, but we can adopt his method and his broad point of view. We can encourage the kind of training that he felt he needed; we can urge our students to work broadly and not hesitate to go into new fields. He called himself first a physicist or chemist. We are entomologists, but is that going to restrain us from knowing zoology or botany or even some chemistry? I hope not.

And so my recommendation to you, based on an experience of twenty-five or thirty years in teaching entomology, is that we try to give our students the broadest education we can, in the time given us to work with them.

PRESIDENT J. G. SANDERS: I want to thank each of the members who have taken part in this program. This might be called "the uplift session" of this meeting, and the keynote of Dr. Kellogg's talk has been "Courage."

We will now proceed with the discussion.

MR. P. J. PARROTT: I have enjoyed listening to the addresses very much, and desire, first of all, to express my appreciation to those who have had a part in this program. Then again, the paper entitled "The Employer's Viewpoint on an Entomologist" was not presented, and what I have to say bears largely on that subject. Now and then I lose an excellent worker from our staff, and it is sometimes very difficult to find one who will fill the place acceptably. The difficulty arises largely from the narrow training of the average entomological worker. Many of the men who apply for positions are trained to approach their problems from the avenues of insect morphology, life-history studies, taxonomy, etc. In order to make any substantial progress with our problems there is need of men with broader training, who have some knowledge of chemistry or plant physiology, or soil physics, and so forth, as has already been pointed out. There are certainly great opportunities for men with high ability who can attack specific tasks of a difficult character.

I am very glad that Mr. Moore pointed out the need of more training in chemistry. So many of our problems in New York relate to the control of insects by means of chemical substances. I think that a young student who shows some ability along chemical lines would do well to consider seriously the question of thorough training in chemistry. I need only point out the accomplishments in recent years with corrosive sublimate, paradichlorobenzene, contact dusts, etc., as indicating what triumphs we may expect in the future if men with technical ability would attack other similarly difficult problems of outstanding importance.

And then, from the standpoint of the effects of such accomplishments on our profession as a whole, you cannot ignore the fact that triumphs of this character must make a profound impression upon the public. We see that in New York with regard to the control of peach borer with paradichlorobenzene and root maggots with corrosive sublimate. There is created a most favorable impression when insects of that character,

which have been considered invulnerable, are finally demonstrated to be quite sensitive to treatment. Triumphs of that character must exert a tremendous influence on the public and should make it more easy to secure funds to attack other difficult problems.

So I would like to reiterate what has been said before, that entomology is, after all, not an independent science, and there is no reason why a man cannot be a chemist or a plant physiologist or an economist and still be an entomologist.

MR. L. O. HOWARD: Mr. President, this subject was one of the subjects of discussion at the Conference of the Imperial Bureau of Entomologists in London, two years ago, and it is extremely interesting to make a comparison between the discussion that took place there and the discussion taking place here today.

In the first place, they had no speaker who had the experience and the authority of Dr. Osborn. They had no speaker who in his experience and in his force of presentation equalled Prof. O'Kane and Dr. Ball. They had no one who could compare with Dr. Kellogg, it goes without saying. Nevertheless, they had a most interesting discussion and they arrived at precisely the same conclusion that we are arriving at today, that the broader the training of the economic entomologist, the better it will be for economic entomology, and the entomologists themselves.

Some curious incidents connected with the discussion were these: In the first place, it was opened by Maxwell LeFroy, who, when he first returned from India, you will remember, read a lecture in South Kensington, on the training of an economic entomologist. It was a rather theoretical talk and it was interesting because he came to the same conclusion that we have reached. However, he said nothing whatever about the training of economic entomologists in America, where it has been carried much farther than in any other part of the world.

And after nearly every one had spoken there was a general call for Robert Newstead, of the Liverpool School of Tropical Medicine—a man of great accomplishment and high standing. He is a man, however, who had no technical training but was taken up as a promising young man by Eleanor Ormerod. He had educated himself, and it was interesting to see his reaction to this conclusion that we were gradually arriving at, and rather to our surprise, Newstead agreed with us and he said that of course the economic entomologist must have as broad an education as possible, Not having had a college training himself, he

might have overestimated the worth of the training, but he did believe that there should be the broadest possible training.

MR. GEORGE A. DEAN: I have listened with much interest and I must say also great profit to the splendid addresses that have been given on this important subject. But several times I have wondered how many of you have read the outline that was given by Dr. C. R. Mann of the Carnegie Foundation for the Advancement of Teaching in his Report of Progress in the Study of Engineering Education, which report was given a few years ago or at a time that several of the various engineering associations were considering the proper training of a man for engineering work.

I don't know that our work differs so much—in fact, in my mind it doesn't differ at all from the zoologist—or the chemist—or even the engineer. This outline has not been prepared by a psychologist. (I don't mean by this that I have no faith in psychology, for I certainly have). But it does seem to me that there are some things in this outline that are well worth considering, particularly when it has been prepared by some of the foremost engineers in this country, or by a group of men who have put across some of the greatest projects the world has known. With your permission I will write this outline on the board. Understand, in giving this outline I am not writing it as my outline, but as one that appeared in the Proceedings of the Society for the Promotion of Engineering Education.

The first is:			
PERSONAL QUALITIES—			
Character,	24%		
Judgment,	19½%		
Efficiency,	16½%		
Knowledge of men	15%	Total	75%
The second heading is:			
TECHNICAL EQUIPMENT—			
Knowledge of Fundamentals,	15%		
Technique,	10%	Total	25%
			100%

Now no one believes in a broad, fundamental training, more than I do, not only in science but in any other lines. But in the last analysis are we so much concerned with what a man knows, as what can he do with what he knows?

PRESIDENT J. G. SANDERS: May we have a few words from Mr. Marlatt on the training of the young entomologist?

MR. C. L. MARLATT: Your courage, Mr. President, I see, gives no signs of waning!

I should be only too glad to speak if I had anything to add to what has been said. I often think that the best compliment that can be given to a good presentation of a subject is—let it settle down, soak in, rather than to debate it.

I think this afternoon has been something of an exception. The discussion has added much of value. My belief is that the clearest presentation of the need is the analysis placed on the blackboard by Mr. Dean, and the important point brought out there is the 75% value placed on personal qualifications. The best qualities in most men are born in them; they may be improved and elaborated by training, but you have got to have them to begin with. You can't take a person who has not the fundamentals of character, and judgment—horse sense, we mean by that—willingness to work, and the achieving spirit, and put these qualities into him by education and training. He must have a grounding in those elements of character, born in him.

I would give a good deal more for that sort of a man than for one with technical education and lacking in these qualities. Such a man will get education and training, either in school or later in life.

Another thing of the greatest importance to the future of our profession is that the instructors in our Science in the schools and colleges shall have such standing and ability as to arouse interest, and attract to their subjects young men and young women possessing these higher qualifications. It is natural that other phases of human endeavor have attracted many of the better grade of men. There are greater rewards in other fields. But if you get the right kind of a professor, who will inspire enthusiasm, his students will get the viewpoint of adding to human knowledge, and get them somewhat away from the line of thought of the mere money reward. We will find I think that our best men trace back, as was brought out by several speakers, to the teachers in the schools, who attracted them—Agassiz, Osborn, Kellogg.

I remember discussing this same matter years ago with a man who has been prominent in zoological research work and who stands at the head of his line of work, and he said, "What I would like to do in getting assistants would be to look over the college graduates and pick out the men with those qualifications which are rated in the schedules at seventy-five per cent. I don't care whether they have any technical training in my line or not!"

PRESIDENT J. G. SANDERS: If there is no further discussion, we will

take up the first question which is "How can the instructor maintain a vital interest on the part of students who are taking a beginning course in Economic Entomology as a required subject in agricultural courses, but who have no intention of specializing in Entomology?"

MR. D. M. DE LONG: Those of us in agricultural colleges face this problem more than those who are training entomologists alone. The students come into the entomological course, which they are required to take as a part of the agricultural course, with an indifferent attitude. That must be overcome and you must get the student into a receptive attitude first.

Now that is accomplished easily by presenting to the student the importance of entomology, its importance in agriculture, and in showing, in addition to that, what is being done in the United States at the present time, in the big entomological problems. When you have finished stating these things to the student, he is in a state of mind to accept anything that you want to teach him in entomology.

Furthermore, if a man is going to take one term or one semester's work in entomology, is it wise to spend most of that time to give him details of antenna or leg structures, or is it better to take up economic entomology as such?

If one teaches economic entomology he must have an acquaintance with field problems, because you cannot teach only from a book. It is a subject that must be taught from field experience and observations, and the student must be taught to see the field problems so that when he goes back to the farm or takes up county agent work, he can face field problems as he finds them.

I feel, then, that in the beginning course in economic entomology we must sacrifice the first training that a man should perhaps have in entomology, in going ahead with his profession, for the ninety-eight per cent who are taking it, to benefit themselves in their general work in agriculture and later to give a man the special training that he needs in the field of entomology if he intends to follow it as a profession.

PRESIDENT J. G. SANDERS: The next question is "How can students be helped to see the work of insects and their control under field conditions when the instructor has them only at a time of year when many important species are not active?"

This is one of the most serious problems that the instructor in economic entomology has to deal with in the northern institutions.

MR. H. T. FERNALD: Had I felt called upon to speak on the first question of the question box, I should have said that there was a phase

of psychology in it as a result of which a requirement to do a certain thing or a requirement not to do a certain thing is always provocative in the human mind, of a desire to do the other. Even a Constitutional amendment has failed to overcome that, as we have evidence.

Personally, after having had experience in teaching, both as a required subject and as an elective subject, the beginning entomology of a college course, I have reluctantly come to the opinion that in the long run all entomology in college should be elective. I realize that that involves certain undesirable features, but I am also of the belief that we gain in the long run more than we do by having all men required to take it. I will dismiss the first question with that answer.

As to the second question, I will frankly say I don't know. There are a few small things which can be done, and which I have done, with perhaps mediocre success. If I can carry the beginning students along to a point where I can bring in some egg clusters and have them hatch, before the students leave in the Spring, we can show them some of the changes which occur, and that is helpful. But when it comes to the vast number of our economic problems, which manifest themselves only during the summer months, the only solution I can see is in the form of summer courses. In some places these summer courses may be practicable but I am personally dealing quite largely with students who are obliged to put in a portion of the year in earning money with which to go on during the remainder of the year, and the summer months furnish them with that opportunity. It becomes therefore largely impracticable to require them to stay for summer courses; and while we have at the Massachusetts Agricultural College in theory a four term year or a four quarter year, the fourth quarter rarely has any subject offered in it, because of that reason, and I have not felt like pressing that matter.

I think the real way of getting at it under such difficulties, therefore, is to arouse such an interest in the subject, while you have the students, that they will be keeping their eyes open after they go out during the summer; and it is my experience, that many of them will come back in the fall, not with an understanding of what they have seen, but an intense curiosity to have explained what they did see. And if you have gotten curiosity aroused, that is the first step, at least, toward the development of interest and a desire to go on.

President J. G. Sanders: The third question is "How can the necessary laboratory work in the structure of insects, for example, be made definitely interesting to the average non-specializing student?"

MR. C. L. METCALF: I should very much prefer to listen, but I don't like to see these questions go by without more discussion.

In definite answer to this question, I should say that in my opinion the way to make the structure of insects interesting to a student is, first, to *make the active, living insect mean something to him.* The average student in college is interested in a subject in direct ratio to its answer to these three questions: What relation does it bear to his past experience; what obvious relation does it have to his anticipated future; and third, is it in itself directly interesting or attractive?

I think we shall have to admit, most of us, that the study of the structure of dead, more or less decomposed insects, is not in itself very interesting to the average non-specializing student of entomology. Therefore, we must make the most of the other points.

I have tried in the last three years in my teaching of beginning courses, the simple expedient of beginning the course in a way that hooks up, I think very nicely, the work of the course with the students' previous experience with insects.

No student who comes to college can have lived as much as five years in America, I think, without having had some definite vivid experience with some living insect. By the time he becomes of college age, he has had probably several such experiences.

The first period in my course I have therefore devoted to the simple and somewhat superficial diversion of making the students tell me *something that they already know about insects,* and I make them write it on the board. I shouldn't say "make," because they get into the game and a little rivalry soon results in a blackboard full of interesting things, ranging all the way from fights with bumble-bees to spraying for the codling moth. This little thing connects up the student's past experience with entomology, and makes him feel that entomology is not some form of discipline forced on him by a hard-hearted faculty, but a live subject dealing with a common and important phase of his environment.

In the second place, the relation to his anticipated future is something that can be taken up best by the method suggested by Dr. DeLong; by giving a comprehensive survey of the relation of insects to human welfare. In fact, much against the judgment of some of my colleagues, I have been turning the thing around, putting the cart before the horse, they think, in the beginning courses in entomology, by having the first course not a course in structure or classification of insects at all, but a course in the relation of insects to human welfare. In the first course in

entomology my students study insects of corn, of vegetable crops, insects of the household, insects of domestic animals and of the greenhouse and so on through the list of economic groupings, rather than to study them as Orthoptera, Coleoptera, Lepidoptera, etc.

In that way I feel convinced in my own mind that I reach the student in a way that gets up a momentum that will carry him through the following semester of more or less "dry" morphology and classification.

In other words, in my brief experience, I have been forced to this opinion somewhat against my will, that the way to get students interested in entomology is first, to *give them what they want*; and by that I mean, something that has a vital connection with their past experience and anticipated future; and after you have filled them so full of what they want that they can't hold any more of that, they will graciously and enthusiastically take what you want to give them.

MR. R. N. CHAPMAN: I realize that I am too young to say anything worth while, but I have been interested in this program and greatly impressed with the difficulty of educating myself. In the little teaching I have done, I have learned that there are some things that are hard to outline in a hard and set program of courses. I also believe that some of the qualifications on the board there apply to the instructor to a large extent and account for the success of his students to a considerable extent. If you were to look over America and see where our schools of entomology have been, I do not think you would be able to correlate them at all with the courses outlined, but you would correlate them directly with some great personalities.

Outside the field of entomology in a little college in the West, where the total number of students was only about two hundred, a teacher there in two years interested six people who are now known in the line of zoology.

We have about eight hundred students taking our general course now. The number who go on is not very great, but those who do go on can be correlated with the laboratory instructors they have. They are all getting the same laboratory outlines, but certain of those instructors inspire students to go on, while some of the others do not.

So I am afraid it is difficult to outline a course which would be applicable to everybody and could be taught with the same success by everybody.

PRESIDENT J. G. SANDERS: Is there any further discussion?

I believe the benefit that has been derived from this symposium and discussion far outweighs what can be secured from a much longer program

of papers. The exchange of opinions on the part of the older and more experienced entomologists and teachers, is of great value.

A paper will now be given by Mr. L. A. Stearns.

SPREADER TESTS ON APPLES AND PEACHES[1]

By L. A. Stearns and W. S. Hough, *Virginia State Crop Pest Commission*

Abstract and Conclusions

Casein and Flour-Paste have received considerable attention for some time as spreaders and adhesives in spray solutions. In 1922, orchard tests were conducted with Kayso, a prepared casein spreader, and Magnet Dry Paste, a prepared flour-paste spreader to determine their effectiveness as influencing the spreading and adherence of the summer applications in the scheduled programs for apple and peach spraying in Virginia.

Neither of the spreaders used increased the effectiveness of the spray solution in protecting the fruit from insects and diseases. The same was true in case of the foliage. It is doubtful that the addition of a spreader, such as the two used, would pay for the increased cost of the spray. Nicotine Sulphate 40% (Black Leaf 40) and casein (Kayso), as used, were uncongenial.

The use of a spreader for sprays has developed recently from a recognized need of increasing the effectiveness of the spray solution. It has been demonstrated in the laboratory, but less certainly under orchard conditions, that certain materials possess specific characteristics which influence the spreading and adherence of sprays. Among these, casein and flour-paste have received considerable attention. Kayso, a prepared casein spreader, which has been widely advertized, and Magnet Dry Paste, apparently identical with the flour and billboard pastes, which have been recommended highly, are the two products used in the tests reported herein. The results represent one seasons' work only, and as such, are preliminary rather than final.

Tests With Casein and Flour-Paste Spreaders on Apples

These tests were conducted in Ophir Orchard at Leesburg and in the Kinzel Orchard at Winchester, the owners, Mr. L. Clark Hoge and Mrs. George Kinzel, cooperating. Both are hillside orchards. Ophir Orchard contains 12-year old Staymans interplanted with Yellow Transparents and Jonothans in contoured rows, while the Kinzel Orchard is a solid block of 21-year old Yorks.

The Virginia spray calendar for apples, in 1922, called for 5 quarts of standard lime-sulphur and 1 pound of powdered lead arsenate to 50

[1]The tests at Leesburg and Vienna were conducted by the senior author, and at Winchester, by the junior author.

gallons of water to be applied: (1) when the cluster buds are pink, (2) when the petals are falling, (3) two weeks after petal fall and Bordeaux mixture, the 4-5-50 formula, and 1 pound of powdered lead arsenate to 50 gallons of the solution, (4) four weeks after petal fall and (5) ten weeks after petal fall.

The experiment was planned to include four tests, all varieties occurring in each. Test or Plot 1 was to receive all summer applications as scheduled without a spreader; plot 2, a casein spreader in the "two weeks" application; plot 3, a casein spreader in all applications; plot 4, a flour-paste spreader in all applications. Casein (Kayso)[2] was used at the recommended rate of 1-½ pounds, and flour-paste (Magnet Dry Paste)[3], 3 pounds to 200 gallons of spray solution.

The spray outfit at Ophir Orchard was a 200 gallon Friend equipped with two rods bearing four nozzles each, and a pressure averaging better than 200 pounds was maintained in all applications. In the Kinzel Orchard, a Hardy "Big Three" equipped with two single-nozzle guns was used; the pressure maintained varied from 250 to 300 pounds. In both cases, one lead was operated from the tower and the other on the ground. The spray materials were mixed by the writers, and the applications made by the regular orchard force under their supervision.

At picking time, each variety was graded separately, and the results tabulated. The variation in the amounts of injury in the several plots within varieties was found to be so uniform that the complete results have been summarized by plots in Table 1.

TABLE 1—RESULTS OF TESTS WITH CASEIN AND FLOUR-PASTE SPREADERS ON APPLES, VIRGINIA, 1922

Type of Injury	Plot 1 10,421 Apples		Plot 2 10,949 Apples		Plot 3 12,680 Apples		Plot 4 11,131 Apples	
	Regular Treatment No Spreader		Casein Spreader in One Application Only		Casein Spreader in All Applications		Flour-Paste Spreader in All Applications	
	No.	%	No.	%	No.	%	No.	%
Codling Moth	12	.12	109	.99	51	.40	37	.33
Leaf Roller, Bud Moth	100	.96	293	2.67	270	2.13	167	1.49
Curculio	614	5.89	351	3.20	312	2.46	279	2.50
Scab	811	7.78	1349	12.32	1266	9.98	1255	11.27
Black Rot Bitter Rot	269	2.58	489	4.46	242	1.90	310	2.78
Spray Burn	51	.49	5	.04	23	.18	24	.21
Plot Averages		2.97		3.94		2.84		3.09

It is apparent from the results in Table 1 that as far as insect and disease injury is concerned the spray without a spreader gave equally as

[2]Kayso—California Central Creameries, 277 Broadway, New York City.

[3]Magnet Dry Paste—Penn Paste Milling Co., Wilkes-Barre, Pa.

efficient protection to the fruit as the spray with either of the spreaders added. There is no appreciable difference in the relative amount of injury in the several plots.

Foliage Observations. The suggestion has been made that some spreaders, on account of their protein content, might provide a medium in the spray solution in which disease spores could germinate. An examination of 3,000 leaves selected at random, 1,000 from each of the three plots of the York Imperial variety, failed to show that this actually occurred to any extent. In the case of *Rust*, (*Gymnosporangium juniperi-virginianae*), the percent of infested leaves was as follows: no spreader, 22.5 percent; casein, 22.6 percent; flour-paste, 22.7 percent; again, in the case of *Frogeye*, (*Physalospora cydoniae*),: no spreader, 2.1 percent; casein, 1.9 percent; flour-paste, 1.0 percent. It is impossible to conclude, therefore, that the addition of the spreaders either increased or decreased the fungicidal value of the spray with respect to the fungi on the foliage.

The general condition of the foliage in all plots and on all varieties revealed nothing in favor of the use of either spreader. Of course, the dried spray material was more apparent where casein and flour-paste were used, but the more conspicuous and apparently more uniform spray covering failed to provide a better protection for the foliage.

Tests with Casein Spreader on Peaches

The information in this particular is incident to the Oriental Fruit Moth project of the Crop Pest Commission. Spraying operations in the experimental control of this insect in 1922 were conducted in the Chilcott Orchard at Vienna. This is a young apple orchard interplanted with peaches of the Carman, Hiley, Belle and Elberta varieties, of which 1,600 are now in bearing.

The regular summer treatment given in this orchard is as follows: (1) 2 to 8 days after petal fall, 4 pounds of powdered lead arsenate and 16 pounds of hydrated lime to 200 gallons of water; (2) 3 weeks after 1, the same again with 20 pounds of atomic sulphur added; (3) one month before fruit ripens, 20 pounds of atomic sulphur to 200 gallons of water.

In this experiment, four of the test plots in which all varieties were represented gave results pertinent to the effectiveness of casein as a spreader. Test or Plot 1 received the regular treatment without a spreader; plot 2, a casein spreader in all applications; plot 3, nicotine sulphate 40% in all applications; plot 4, nicotine sulphate 40% and

casein in all applications. Nicotine Sulphate 40% (Black Leaf 40) was used at the 1 to 800 dilution and casein (Kayso) at the recommended rate of 1-½ pounds to 200 gallons of the spray solution.

The spray outfit used was a 200 gallon Friend, equipped with two single-nozzle guns; the pressure maintained was slightly less than 200 pounds. The materials were mixed, and the applications made, by Chilcott Brothers.

When the peaches were picked, they were graded and results tabulated by varieties. As in the case of the apples, the variety variations were so slight that the results have been combined by plots in Table 2.

Table 2.—Results of Tests with Casein Spreader on Peaches, Virginia, 1922

Type Of Injury	Plot 1 57,698 Peaches		Plot 2 49,753 Peaches		Plot 3 47,634 Peaches		Plot 4 97,821 Peaches	
	Regular Treatment No Spreader		Regular Treatment With Casein Spreader		Regular Treatment With Nicotine Sulphate 40%		Regular Treatment With Nicotine Sulphate 40% and Casein Spreader	
	No.	%	No.	%	No.	%	No.	%
Curculio	2680	4.64	1927	3.87	2874	6.03	4143	4.23
Brown Rot	189	.32	87	.17	91	.19	795	.81
Scab	16	.03	15	.03	60	.12	70	.07
Spray Burn	192	.33	69	.14	309	.64	185	.18
Plot Averages		1.33		1.05		1.75		1.32

The results on peaches in Table 2 parallel the results on apples in Table 1. Here again, the spray without a spreader gave equally as efficient protection to the fruit as the spray with a spreader added.

President J. G. Sanders: The next paper is by Mr. R. H. Smith.

SPREADERS IN RELATION TO THEORY AND PRACTICE IN SPRAYING[1]

By Ralph H. Smith, *San Francisco, California*

Abstract

Fog spraying works out poorly. Much can be said for high power spraying. Spreaders give a uniform covering with low pressures. Substances with very low surface tensions, such as saponin and soaps give too thin coatings, caseinate a thicker film deposit without affecting compatiblity. Wind and rain doubtless affect efficiency. A suitable spreader, such as calcium caseinate, increases efficiency, as shown by tests with the codling moth, *Carpocapsa pomonella*, green apple aphis, *Aphis pomi* and woolly apple aphis, *Eriosoma lanigera*.

The tendency of sprays to collect in drops on smooth surfaces and the action of rain and wind in removing spray materials after they have

[1]Contribution from the Research Laboratories of California Central Creameries.

once dried, are factors which doubtless have an important bearing on the efficacy of spraying in controlling insect and fungous enemies of plants. Spray spreaders and adhesives have been studied and used in a limited way in various countries, but they have not come prominently to the attention of students of pest control in America until the past two or three years. Efforts to increase spraying efficiency have been directed chiefly toward the improvement of spray machinery and equipment rather than toward improvement of the physical properties of spray solutions and mixtures. In order to secure a more even distribution of spray material as well as to get a more complete coverage on fruit and foliage, a great deal of emphasis has been placed upon the use of high powered sprayers and the mist or fog type of spray.

The "fog theory" of spraying requires that the spray carry out a short distance from the nozzle, then break into very fine mist particles which, like the particles of moisture in a fog, would suspend in the atmosphere and come to rest so thickly and evenly on the surface of an apple, for example, that the result would be tantamount to an unbroken film of spray. Much may be said in favor of high-powered sprayers but fog spraying, on the whole, works out very poorly in actual practice. Probably not less than seventy-five per cent of spraying, the country over, is done with sprayers which do not give sufficient pressure for effective fog spraying. Furthermore, the technique of ideal fog spraying is exacting and requires decidedly more thoughtful manipulations than the average sprayman will give. Finally, satisfactory fog spraying is very difficult, if not impossible, where any considerable wind may be blowing. Even under optimum conditions one finds that in order to reach all parts of the tree some parts will become oversprayed, with the result that the spray collects in drops, leaving the surfaces unevenly covered and less effectively protected.

The film spray, such as is obtained by use of a spreader, is well applicable to practical spraying conditions. Spreader enables one to secure the same uniform covering of spray with low pressure as with high pressure sprayers, although it should be stated that high pressure, giving a fine, driving mist, is most efficient and economical. By using a suitable spreader and spraying equipment that is reasonably efficient, it is within the bounds of practicability for the orchardist to effect a fairly uniform, continuous and complete covering of spray material over the fruit, leaves or bark of his trees. Contrary to popular conception, spreaders do not cause the spray to spread or creep, at least to any material extent, from the sprayed side of an apple, for example, to

the opposite side, that has not been sprayed. With calcium caseinate, especially, the spreading occurs at the instant the spray strikes and there is no secondary spreading; hence, in order to get complete coverage, it is necessary to spray a tree at least from opposite sides, if not from a number of different positions, the same as ordinarily is done. The introduction of a spreader also affords opportunity to accomplish other desirable improvements in the physical and chemical composition of spray mixtures and solutions, which in themselves are of much importance.

The writer is not prepared to undertake at this time an extended discussion of the qualities and merits of the numerous substances that have been tested as spreaders; therefore, only certain phases of the subject are here considered. The thickness of the film-deposit, or the dry material that remains after the liquid film evaporates, is of much importance in choosing a spreader. In case of dormant spraying, for example, it usually is desirable to effect a comparatively thick coating of material on the bark, and the same applies, though perhaps in a more general way, to fruit and foliage sprays. Substances having very low surface tensions, such as saponin and soaps, are efficient in producing spreading and film formation, but the resultant film-deposit of spray material is so thin, at least in case of arsenate of lead, that there may be doubt as to its efficiency in giving protection to the sprayed surface. Caseinate gives a thicker and more durable film-deposit than do the above substances. Calcium caseinate possesses certain qualities not well understood, which cause a rapid fixation of the liquid film, and this gives promise that within certain limits we may be able to govern, according to various requirements, the thickness of the film-deposit.

Compatibility with the various standard and proprietary insecticides and fungicides, as well as with spray waters of varying alkalinity, is a qualification that alone is sufficient to eliminate a number of spreaders that have been tried. Soaps, such as commonly are used with nicotine sprays, show a marked tendency to produce flocculation, precipitation and insoluble soaps, which deleteriously affect the physical and chemical composition of spray solutions and mixtures. These substances, and also sodium caseinate (casein dissolved with sodium hydroxide), when used with arsenical spray mixtures, tend to increase the amount of soluble arsenic in arsenical compounds and to lessen the stability of combined sprays. Calcium caseinate appears to exhibit none of these defects, so far as we have been able to determine at the present time. Miscible oils are good spreaders and possess some additional qualities

which commend their use especially with dormant sprays, but incompatibility with sulfur and bordeaux compounds, as well as with arsenicals, is an important barrier to their practical use.

Although further experimental evidence is needed on the point, there can be no doubt that rain and wind exert a great influence in reducing the efficiency of sprays. By combining suitable adhesive qualities in the spreader, it is possible not only to overcome to a considerable extent the deleterious effects of rain and wind in removing the spray material, but also, by lengthening in this manner the period over which a spray application will give protection, to reduce the number of applications necessary to control certain pests. Hence, the adhesive qualities of a spreader becomes of much importance. The casein type of spreader has shown superior adhesiveness in comparison with saponin, soaps, oils and gum arabic.

A consideration of the more important factors involved leaves little room for doubt that a suitable spreader is efficacious in giving increased control of those insect and fungous pests which in general are amenable to the spraying method of control. However, adequate orchard, field and garden spraying experiments to determine this point with accuracy, have not yet been consummated. Carefully conducted orchard and insectary tests, made by the writer in Idaho during the years of 1920 and 1921, gave results which indicated very positively that calcium caseinate, used with arsenate of lead, is capable of giving improved control of codling moth. These tests also showed clearly that the addition of calcium caseinate to the combined spray of arsenate of lead and nicotine sulfate, gave much better control of green apple aphis (*Aphis pomi* DeG.) and woolly apple aphis (*Eriosoma lanigera* Hausm.) than did the same spray materials when used without the spreader. Furthermore, the experiments indicated that with the spreader, apparently due to its adhesive qualities, it would be possible under Idaho conditions to omit the second cover spray for codling moth without impairing the effectiveness of control.

The rather general use of a commercial calcium caseinate spreader during the past year in practically every fruit growing section of America, shows with reasonable conclusiveness, if we assume that the orchardist himself is capable of judging correctly that this type of spreader possesses decided merit in increasing spraying efficiency and giving improved control of various pests for which sprays are applied.

MR. G. E. SANDERS: I would like to ask whether increased burning results from calcium caseinate in combination with straight arsenate of lead.

MR. R. H. SMITH: That has never occurred in actual orchard spraying. The charts that Mr. Stearns showed indicate that calcium caseinate decreased burning. We have run 46 samples and in each case the calcium caseinate decreased burning.

MR. G. E. SANDERS: That is arsenate of lead combined only with calcium caseinate?

MR. R. H. SMITH: Yes.

MR. B. A. PORTER: We have used plain arsenate of lead with calcium caseinate in Connecticut and there was no burning.

MR. W. P. FLINT: The difference was only 1 or 2 per cent in Illinois and in some cases the percentage of worms in the lot sprayed where the spreader was used, was greater than where it was not used.

MR. G. E. SANDERS: I want to say that from an analytical standpoint the relation of calcium caseinate to lead arsenate should give increased burning; because when we had Mr. Kelsall at the laboratory we did careful work on the addition of varying quantities of lime to lead arsenate and where he used less than ten per cent by weight of lime with lead arsenate he increased the amount of soluble arsenic greatly, and where the amount of lime was more than ten per cent, there was a decrease in the amount of soluble arsenic; so that with the small amount of lime that there is in calcium arsenate, I would expect to get quite an increase in the amount of burning.

MR. WILLIAM MOORE: I would like to say a word about the reactions of lime and lead arsenate and calcium caseinate and lead arsenate, and what we define as soluble arsenic and arsenic that will cause burning.

It is true that if you add lime to lead arsenate that the amount of soluble arsenate increases. It has also been demontsrated, I believe, for a number of years, that the use of lime with lead arsenate will usually reduce burning. When lead arsenate is in contact with water, a reaction occurs which produces a certain amount of soluble arsenic, which soluble arsenic is in the form of arsenic acid. When you add lime it is no longer arsenic acid, but calcium arsenate.

Now the solubility of the arsenic compounds present in solution may have a bearing on the degree of burning. In other words, you can have two solutions with identically the same amount of soluble arsenic, one in the form of calcium arsenate and the other in the form of arsenic acid. These two solutions may give entirely different results on foliage. An

excess of lime suppresses the ionization of the calcium arsenate. The small amount of calcium in the calcium caseinate will produce a small amount of calcium arsenate, but there will not be sufficient to suppress the ionization of the calcium arsenate formed. The addition of further lime will reduce the soluble arsenate.

PRESIDENT J. G. SANDERS: Is there not considerable difference in the quality of the water used in different parts of the country?

MR. WILLIAM MOORE: A big difference.

In the South you would have another factor due to an alkaline water, which reacts with lead arsenate. The presence of sodium carbonate will produce sodium arsenate which probably gives different results from either the arsenic acid or the calcium arsenate.

MR. P. J. PARROTT: At present in New York State the matter of stickers is of great interest, and one of the problems of the economic entomologists is to advise the growers wisely. There is considerable difference of opinion as to their value.

MR. W. S. REGAN: During the past season we used several hundred pounds of calcium caseinate spreader in connection with our arsenical sprays against the fruit tree leaf-roller, in the orchards of the Bitter Root Valley, Montana. We found that this spreader added materially to the efficiency of the arsenical sprays. In fact, with six to eight pounds of arsenate of lead, to the two hundred gallon tank, and one to two pounds of the caseinate spreader, we were able to obtain a kill of approximately ninety per cent of the caterpillars, when application was made at the calyx period, immediately after the falling of the blossoms. Also the addition of the caseinate spreader, when arsenate of lead and lime sulphur are combined, prevents the decomposition and formation of black sludge, which results when the spreader is not added. One to two pounds of spreader is more effective in preventing the decomposition than ten pounds of hydrated lime.

MR. WILLIAM MOORE: I would like to bring up another question while on this subject and leave it to you to think about. A few months ago I was going through the Edgewood Arsenal and I was very much surprised to see the amount of bottled milk standing about. Dr. Cook was with us at the time and being curious asked, "Why do the people drink so much milk here?" The answer was that the workers with arsenic compounds found that the use of milk aided in the elimination of arsenic.

PRESIDENT J. G. SANDERS: The question of stickers is comparatively new and it seems to me that more information is needed from various

parts of the country where different conditions exist in order to obtain definite information.

The next paper is by W. E. Britton.

RAPID SPREAD OF THE APPLE AND THORN SKELETONIZER, *HEMEROPHILA PARIANA* CLERCK

By W. E. Britton, *State Entomologist, New Haven, Conn.*

ABSTRACT

This European insect, *Hemerophila pariana* Clerck, first appeared in the United States in Westchester County, N. Y., in 1917 and in Greenwich and Stamford, Conn., in November, 1920. In 1921, first brood injury was prominent and adults were abundant in Greenwich and Stamford and before the close of the season records indicated that this insect occurred in all counties of Connecticut except Windham County. Late in 1922, unsprayed apple trees were brown from its attacks in the vicinity of New Haven and northward through Hartford. It was also observed in Windham County, Conn., and in Huntington and Amherst, Mass. Adult moths were very abundant on window screens in late fall and it is believed that it passes the winter in the adult stage, and that it spreads chiefly by adults moving with the prevailing winds. Dr. Felt reports an invasion just south of Albany, N. Y. It is believed to be in northern New Jersey, though definite proof is not at hand.

This insect was first discovered in Westchester County, N. Y., during the summer of 1917, and was apparently an accidental introduction, perhaps from Europe. The center of the infestation was at Irvington, Westchester County, but it was soon found across the river in Rockland County. Dr. E. P. Felt early published a brief note[1] calling attention to the presence of the pest, and later gave in a bulletin[2] and also in one of his reports[3] fairly complete accounts of the insect. He warned me to watch for it in Connecticut as the infestation was only a few miles from the Connecticut border.

It was not until November 1920 that the insect was noticed to be present in Connecticut, first at Belle Haven, in the town of Greenwich, where its injury was the most conspicuous, but later in Stamford where a small amount of injury occurred here and there. Both of these towns are situated in the extreme southwest corner of Fairfield County, and of the State. A brief account of this insect based upon Dr. Felt's publications, and recording its occurrence in Connecticut was published[4] in my twentieth report as State Entomologist.

The following summer, 1921, reports indicated that the injury caused

[1]Journal of Economic Entomology, x, 502, October 1917.

[2]Cornell Extension Bulletin, No. 27.

[3]Thirty-third Report N. Y. State Entomologist, 33, 1917.

[4]Report Connecticut Agricultural Experiment Station, 190, 1920.

by the first brood larave was rather prominent and on June 24 I visited Greenwich and Stamford, and crossed the State line into Port Chester, N. Y. Some apple trees in Greenwich, but many more in Port Chester, had been skeletonized, and the foliage was entirely brown. This had been done by the first generation larvae which had matured, pupated, and many adults had emerged by June 24. When disturbed, the little purplish brown moths flew out of these trees in swarms, and they were common, resting upon the daisies and other flowers about the field. During the season of 1921, this insect and its work was sent to the Station from many different points within the State, and Station entomologists observed it at other places, so that by the end of the season we had records of it from all counties except Windham County in the northeast corner of the State. This seemingly rapid spread was noted in the Station Report for the year.[5]

During 1922, the insect was very abundant about New Haven, particularly late in the season. Nearly all unsprayed apple trees were brown. The writer observed this condition in New Haven, Orange, Woodbridge, Milford, Hamden, Cheshire and along the automobile thoroughfare between New Haven and Springfield. Many inquiries about it were received at the Station and many specimens were submitted for identification. One of the Assistant Entomologists observed the insect in Windham County, so that now we know that it occurs all over the State.

In New York State, according to Dr. Felt, a rather serious infestation of this insect was discovered the past summer in the southern part of Albany County, near Albany, and at present the insect occupies a strip along the Hudson River valley but not extending more than four or five miles on either side from the River. It is believed to be present in northern New Jersey but no very definite records are at hand.

During August the writer examined a number of apple trees and hawthorn bushes in the vicinity of Pittsfield, Mass., without finding any traces of the insect. Dr. B. A. Porter, however, later observed it at Huntington and Amherst, Mass. At Amherst, late in the fall, the adults were quite abundant, and as the infested trees observed would hardly produce them in such numbers, it has been suggested that they migrated northward from Connecticut, where they were very abundant in September, October and November; even a few have been observed since

[5]*Ibid.*, 186, 1921.

December first. These adults were found resting upon window screens all through the fall months. Frequently we have counted as many as fifteen adults on a single screen covering half of the window of the Entomological Laboratory at the Station. Dr. Porter reports that he counted thirty on one screen at Wallingford, Conn.

From the available life history data, published and unpublished, it is apparent that the winter is passed by this insect in the adult stage, though possibly an occasional pupa may live through the winter. It is also evident that the spread of the species takes place chiefly by the adults emerging in abundance and moving in the direction of the prevailing winds.

MR. S. W. FROST: I am especially interested in this pest and in the way it has migrated to the East. I have been on the watch for this pest but have not seen anything of it to date in the southern part of Pennsylvania. In the northern part of the state I have not traveled so much and have not been able to make many observations.

I might say that I have seen outbreaks along the Hudson River and it is rather a striking pest—green with relatively large black spots and it would be very difficult to overlook it. I feel very certain that the pest has not occurred in Pennsylvania and I would be interested to know if anyone has found it in New Jersey or in the northern part of Pennsylvania.

MR. W. E. BRITTON: Dr. Felt has told me that this insect occurs in the Hudson Valley as far north as Albany, but apparently has spread only four or five miles each side of the river. The sprayed orchards were not injured.

PRESIDENT J. G. SANDERS: The next paper is by Mr. W. P. Flint.

SHALL WE CHANGE OUR RECOMMENDATIONS FOR SAN JOSE SCALE CONTROL

By W. P. FLINT, *Urbana, Ill.*

ABSTRACT

During the years of 1920 to 1922 inclusive, the San Jose Scale, *Aspidiotus perniciosus*, has increased very rapidly in southern Illinois and neighboring states. In southern Illinois it has resulted in the loss of over one thousand acres of commercial orchard annually treated with lime sulphur.

Experimental work was carried out in the spring of 1922 with miscible oil and lubricating oil emulsion, similar to those used by the Federal Bureau of Entomology in Florida. The lubricating oil emulsion gave nearly as good control of the scale as did the miscible oil and a much higher degree of control than was obtained from

the best grades of liquid lime sulphur. As a result of this work the lubricating oil will be generally used in southern Illinois during the coming year.

During the past three seasons orchards in southern Illinois have been severely damaged by San Jose Scale. This damage extends over the corresponding orchard districts in neighboring states in the Mississippi Valley, but does not reach north of the 40th degree of north latitude in Illinois. More than one thousand acres of commercial orchard in Illinois alone have been killed in the last two years, and severe losses to fruit have also resulted.

There are more than 40 thousand acres of orchard in southern Illinois. While a number of these are far from being well sprayed there are many growers who make every attempt to keep their orchards free from insects and disease, using up to date equipment and following the method of control advocated by state and federal authorities. A number of these men are University graduates, and are thoroly familiar with the theoretical as well as the practical side of spraying. These men have suffered nearly as heavily as have the poorer class of orchardists. In fact, at the present time there is not one grower in fifty in southern Illinois who feels satisfied with lime sulphur for controlling the San Jose Scale. Whatever the Entomologist may think, it is practically useless to advise these men to continue spraying with lime sulphur, although we have a few cases where severe San Jose Scale infestation has been cleaned up by thoro applications during the past two years, using commercial liquid lime sulphur.

Owing to the above conditions a series of experiments, under the direct charge of Mr. S. C. Chandler, was started at Olney Illinois in the spring of 1922. In these experiments commercial lime sulphur was compared with Spramulsion, Pratt's Scalecide, Diamond paraffin oil emulsion, Soluble sulphur and dry lime sulphur. The trees selected for the experimental work were twenty-five year old Ben Davis and Grimes Golden, in a large commercial orchard which had been sprayed with lime sulphur for the past ten seasons and which was at the time of the experiments very heavily infested with scale, about thirty acres in one part of the orchard having been killed by the scale. The experimental plots were five trees long by four trees wide and the results of the treatment were taken from the center trees in the block. The trees were sprayed on March 28th and April 4th with the wind from the south on the first day and from the north on the last. As thoro covering of the trees as possible was made on both days. From twenty to twenty-two gallons of material was used per tree.

On May 17th, forty-three days after the last application was made, a number of small branches were taken from the tops, center and lower parts of the two trees in the center of each of the spray plots and examinations of living and dead scale were made individually by Mr. J. J. Davis, Mr. P. A. Glenn and the writer, none of whom knew the treatment which had been given to the scale which they were examining. The average of these examinations is as follows:

Treatment	Percent of Living Scale 47 Days after Treatment
Scalecide (1 to 15)	Less than .5%
Spra-mulsion (1 to 15)	.4%
Diamond paraffin fish oil soap emulsion (2%)	1.5%
Junior Red Engine fish oil soap emulsion (2%)	7. %
Commercial liquid lime sulphur (32° Beaume, 1 to 8)	11. %
Soluble Sulphur, Niagara (15 lb. to 50 gals. water)	18.5%
Dry lime sulphur (15 to 50)	41. %
Check, no treatment	50.4%

The remainder of the orchard was thoroly sprayed in the fall of 1921 with steam cooked lime sulphur at a dilution equivalent to one to seven, from the 32° Beaume concentrated solution, and again in the spring with the same material. By October 1st, 1922 most of the trees were incrusted with San Jose Scale, and few apples could be found in the entire orchard that were not badly specked with the scale. Many of the growers in this section have had the same experience.

If with the thoro spraying given in our experimental plots eleven percent of the scale remained alive after the application of dormant spray, it is evident that a more effective material must be used if such can be found which will meet the requirements of orchardists as to availability, freedom from injury to the trees and cost.

Many orchardists in the southern Illinois section have used commercial miscible oils during the past season and on the whole have obtained much better control of the scale than has been the case with lime sulphur. On large trees where from fifteen to twenty gallons of the dilute spray are required to a tree, the cost of the miscible oils makes them almost prohibitive. The homemade lubricating oil emulsions which have been used for a number years by Mr. W. W. Yothers in Florida for controlling citrus insects and which were included in our experiments and have given nearly as good control of the scale as has been the case with commercial miscible oils, at a cost considerably lower than that of the liquid lime sulphur. At the present price commercial liquid lime sulphur for the dilute spray ready to apply to the tree will

cost from 1¾c to 2c per gallon, commercial miscible oils figured on the same basis will cost from 4½c to 5c per gallon and the home made lubricating oil emulsion from ¾ to 1c per gallon.

During the past year several thousand gallons of this lubricating oil emulsion has been applied to southern Illinois orchards, in every case with highly satisfactory results so far as control of the scale was concerned, and in no case resulted in any injury to the trees.

The Federal Entomologists working with these sprays during the past season in Arkansas have obtained similar results to those here reported from Illinois. There is hardly a commercial orchardist in the southern part of the state who does not plan to give at least a part of his orchard a dormant treatment with these sprays. In view of the fact that our work with these sprays covers only one season we are not recommending them.

Under conditions where the orchardists have become dissatisfied with lime sulphur, and where experimental work has shown only a fair degree of control with this material, is it not advisable to recommend the use of the oil sprays, at least until the scale is again brought under control?

Mr. W. J. Schoene: Will Mr. Flint tell us how he makes the mixtures and what strengths he uses in the sprays?

Mr. W. P. Flint: They were made with several grades of lubricating oil emulsified with potash fish oil soap. The formula we have been using is the same as that used generally, which is one gallon of lubricating oil (we have been using Diamond paraffin oil), one half gallon of water, and one to two pounds of potash fish oil soap.

With some waters we found we had to increase the amount of potash fish oil soap and in some cases make it two pounds in order to get a good emulsion. We have used these in all cases in actual spraying in the orchards at a two percent strength. In another experiment the lubricating oil emulsions were tested at strengths of from one to six percent oil. All scale wet with the two to six percent emulsion was killed.

Mr. W. J. Schoene: In the wintertime?

Mr. W. P. Flint: The work was done early in March.

Mr. O. I. Snapp: Was any of that work done on peaches?

Mr. W. P. Flint: We have not used it much on peaches because we felt it was dangerous, and expected injury. Apparently the two per cent oil emulsion can be combined with 4-4-50 Bordeaux and used at the

time when the aphis are clustered on the outside of the buds, giving a combined fungicide, aphicide and scale spray. At a two per cent strength these emulsions will kill the aphis.

MR. W. J. SCHOENE: And will not injure the foliage?

MR. W. P. FLINT: No injury occurred in our experiments last year.

MR. E. N. CORY: What time of year do you get your first crawling young?

MR. W. P. FLINT: Last year the 27th of May, where we were working.

MR. O. I. SNAPP: Do you think one per cent or one and one-half per cent emulsion will control?

MR. W. P. FLINT: We didn't get perfect control until we got up to two per cent.

MR. J. S. HOUSER: Last year I had the privilege of visiting this district in company with Mr. Flint, and the existing condition is the most disconcerting thing along the line of insect control that I have seen happen for a good long while.

We have become, I am afraid, rather complacent in our assurance of our ability to control San Jose scale. It illustrates the point that we as economic entomologists must be on the lookout for new developments with old pests. We simply cannot allow ourselves to become less alert in our observations and in our recommendations.

And since Dr. Howard has compared a part of this program with an earlier meeting in Europe, I should like to compare this section of this program with a part of the program of this Association some years ago, when we heard discussed the use of parasites in the control of San Jose scale, "that the days of using sprays for controlling the scale were over—and that nature would do the job for us!"

SECRETARY A. F. BURGESS: I think that matter might be taken back a step farther, when lime sulphur was used experimentally in the East in a number of places and found ineffective. Later it was used with better results. It may be that there are conditions which have not been given proper attention that will explain the whole reason why years ago it was found ineffective and then became more effective later on.

These same conditions may have been duplicated in the last year or two when the insect has been increasing enormously and doing a great amount of damage.

I believe thoroughly in what Mr. Houser has said, that we cannot be too optimistic about some of these problems that we think are settled, because there are liable to be changes in conditions and there may be

complications come up that affect the problem in such a way that the results we have been getting heretofore will not hold.

MR. WILLIAM MOORE: I would like to raise the question as to the nature of lime sulphur. Manufacturers have been making progress in the development of lime sulphur and other insecticides. Have they made any changes? Is it exactly the same today as it was two years ago? Changes in manufacture might make a difference.

MR. W. P. FLINT: I did not make it clear in my talk that in the three experiments that I mentioned, two different brands of commercial lime sulphur were used and two lots of home-cooked or steam-cooked lime sulphur.

MR. L. HASEMAN: We have been having somewhat the same condition in Missouri naturally, and the same conditions extend into northern Arkansas. During the summer and fall we held a number of scale meetings in the southern portion of the state and I had an opportunity of talking with Mr. Ackerman regarding his experience. We have not been losing the orchards in Missouri that they have been losing in Arkansas and in Illinois. Our better orchard men have been spraying thoroughly and all who sprayed thoroughly up to two years ago, have not lost any orchards. However, the men who have not been spraying thoroughly in the last five years have lost orchards in the last two years.

So I believe Mr. Flint is right when he says that the scale in some orchards had an opportunity of getting so thoroughly established, and so abundant, that with the mild winters, which we have been having, we have not been killing enough of them to keep them under control.

We have had some similar experience with lime sulphur solution, though not as high a percentage of living scale went through our test. Two per cent living scale was the highest we had in our tests in the central part of Missouri.

MR. O. I. SNAPP: We should not lose sight of the fact that in some sections, the effect of San Jose infestation may be attributed to the vast amount of proprietary insecticides being used. The San Jose infestations in Georgia are becoming alarming and we are much interested in this oil emulsion spray. We used it this year in an experimental way but we have not gotten any information as to its having been used on peaches. From a two per cent solution it is thought that twig injury might come.

PRESIDENT J. G. SANDERS: Is that oil a cutting oil?

MR. WILLIAM MOORE: I talked with the manufacturer but he was loath to say much about it. It is an oil which actually forms an emulsion

the particles of which are colloidal. If diluted to a milk appearance it will last for weeks or months in that condition without separating. It is manufactured by the Sun Oil Company of Philadelphia.

It is a by-product and obtained by their method of refining oil. They say that it will be standard and will not vary from time to time.

PRESIDENT J. G. SANDERS: Has it not a commercial use as a cutting oil?

MR. WILLIAM MOORE: Yes. I believe they have tried experiments with it.

Adjournment, 5 p. m.

INSECT PEST SURVEY WORK IN THE UNITED STATES

By J. A. HYSLOP, *Bureau of Entomology*

ABSTRACT

After reviewing the history of Survey work in the United States from 1889 to the present date, and recounting earlier attempts at this type of work by the Bureau of Entomology, the scope and objects of Survey work were set forth in the following words: "As I now conceive the scope of our work, the object of the Insect Pest Survey is to collect accurate and detailed information on occurrences, distribution, ecology, and relative destructiveness of insect pests throughout the United States, to study these data from month to month, and year to year, with relation to the several factors that influence insect abundance, and to prepare this information and the conclusions drawn therefrom in the form of maps and text for the use of all entomological workers throughout the country," with the ultimate object of eventually delineating insect zones in the United States and forecasting insect outbreaks.

An analysis of the chinch bug outbreaks in the State of Kansas during the past fifty years brought out a very decided correlation between the mean annual rainfall and the optimum chinch bug belt in that state. The main thesis brought forward was that Survey work, i.e., the accurate recording of insect abundance from year to year, will indicate, after a reasonable number of years, the zone of optimum ecologic conditions affecting any given insect, and the yearly abundance of an insect will be determined by the departures from these optimum conditions.

In 1893, at the fifth meeting of this Association, Dr. S. A. Forbes very aptly characterized the entomological organization as it then existed when he said: "American economic entomologists are working each by and for himself, altogether without general supervision and commonly without mutual consultation or co-operative plan, with the consequent fact that our investigations are as a whole heterogeneous, determined in each case largely by personal bias and local circumstances instead of by common objects and a general view." That this is not conducive of best results or, to put it conversely, that co-operative and

definite organization is a more efficient means of advancing our science, was recognized as early as the second annual meeting of this Association held in November, 1889, when C. V. Riley said: "In regard to the gathering of statistical information the work of the Department at Washington could be greatly facilitated by the assistance of different entomologists in their respective territories."

By the time of the third meeting of this Association in 1891 the idea of survey work was so well formulated in the minds of these pioneers of American entomology, that Riley, Osborn, and Smith were appointed as a committee of the Association to go into the matter of insect-damage statistics.

In 1893 the Division of Entomology inaugurated a systematic Insect Pest Survey, of which Dr. Howard said, before the Washington Entomological Society at its January meeting in 1895: "I have planned an extensive investigation of the question and am engaged in plotting on a large scale the actual distribution and injurious occurrence of about 150 of our most destructive species, and in this work I hope to have the assistance of most of our entomologists. The whole subject is one which is fraught with the greatest difficulty as well as interest. The broad subject of natural geographical distribution of animals and plants is a sufficiently complicated one but it becomes still further complicated when we come to consider the actual and possible distribution of cultivated species. One small phase of this subject enters naturally into the work of the economic entomologists, although it has, as yet, received no attention. This phase is expressed in the query, How far will a given injurious insect follow its natural food plants when the geographical range of the latter is extended by artificial means? This is a question which can be answered satisfactorily only by a study of each individual injurious species and the facts concerning its origin and present spread, as well as by a study of the laws governing the distribution of the food plant."

Dr. Merriam was present at this meeting of the Society and said that Dr. Howard's paper, in which a number of the more injurious species are correlated with the life zones which he himself had so recently delineated, was the first direct proof of his proposition that there is a direct practical bearing to the question of life zones.

The series of maps mentioned by Dr. Howard at that time were continued for a number of years, but the rapidly growing interest in such important economic pests as the San Jose scale, the cotton boll weevil, disease bearing insects and other matters of pressing importance,

so completely engrossed the time and very limited forces of both the Federal and State entomologists that the work was discontinued on account of insufficient co-operation. The maps, however, are now in the files of the Insect Pest Survey and serve as a background for early distribution records of many of the more important species.

So the Insect Pest Survey is inaugurating no new idea, it is hardly launching a new activity, but its work might be defined as an attempt to realize a long patent economic demand.

At the Chicago meeting (1920) of this Association the Committee on Policy made recommendations, which were later endorsed by the Association as a whole, that the Bureau of Entomology establish an Insect Pest Survey. These recommendations maintained that: "It is obvious that the early recognition of recent introductions will promote the control of newly established pests. This is an important phase of economic entomology. An Insect Survey *designed to ascertain the distribution* and the *extent of injury* caused by various insects and to keep official entomologists throughout the country *apprized of developments* during the growing season would prove of great value in forecasting probable injury. It is recommended that an Insect Pest Survey be organized under the direction of the Bureau of Entomology in co-operation with official entomologists of various States or State institutions."

Early in March, 1921, the Insect Pest Survey was formally inaugurated and has functioned now for a period of nearly two years.

As I now conceive the scope of our work, the object of the Insect Pest Survey is to collect accurate and detailed information on occurrences, distribution, ecology, and relative destructiveness of insect pests throughout the United States, to study these data from month to month, and year to year, with relation to the several factors that influence insect abundance, and to prepare this information and the conclusions drawn therefrom in the form of text and maps for the use of all entomological workers throughout the country.

The results to be obtained from this undertaking over a series of years are manifold. We should be able to throw light on the reasons for the cyclic appearance of insect pests, the gradual shift of regions of destructive abundance, the limiting barriers to normal dispersal, and the directive influences that determine the paths of insect diffusion, and the relation of climatology, geography, topography, and geology, as well as biological complexes of flora and fauna, to insect distribution and abundance. The mapping of insect life zones will aid the working entomologist in more clearly grasping the relative importance of the

problems within his own territory and may even indicate the type of agriculture that will meet with fewest entomological obstacles in a given region.

This sounds like a rather ambitious program but is, I believe, one that can be substantiated even at this early period of the Survey's development. In the State of Kansas, for instance, entomological records have been maintained for more than 50 years, not by any means as completely as they are maintained today, but nevertheless completely enough to meet the present requirements. Through the kindness of Professor G. A. Dean, the Survey was furnished with the chinch bug records for this period. These records have been mapped for the Survey files, the chinch bug being the first insect to which our new system was applied.

The maps showing the annual outbreaks, indicate that chinch bug occurs very generally over the eastern three-quarters of the State of Kansas, shifting in destructive abundance from year to year. A state map was prepared from the annual maps, upon which a dot was placed in each county for each year an outbreak was reported from that county during the last 50 years. Here we have very conclusive evidence that there is a region in Kansas where the ecological complex is highly favorable to chinch-bug development. This region extends over the three eastmost tiers of counties, and forms an almost rectangular block covering the eastern quarter of the State, wherein the mean normal conditions are optimum for the chinch bug. The map shows also that over the eastern half of the State average conditions are within the critical range of this species and that over the western third the pest only occurs when the ecological conditions are subject to such radical departures toward the insect's optimum as to bring them within this critical range.

One might argue that an insect's food plants are the limiting factors in its distribution. This is undoubtedly true within certain limits, but in this particular case the proposition breaks down. Corn and wheat are certainly the two most important food plants of this insect. The chinch bug's optimum range coincides with neither. The most intensive corn belt is along the northern border of the state extending well beyond the optimum range of the chinch bug, while the intensive wheat belt is in central Kansas, also well to the west of this chinch bug belt. The area of intense chinch bug infestation is not coincident with the two most important economic crops it attacks.

But a glance at the rainfall seems to be much more illuminating.

Here we see that the westmost limit of the area in the state having a minimum mean annual rainfall of 30 inches runs west of the optimum chinch bug belt and that two lines of 34 inches minimum mean annual rainfall lie mostly within this belt. An imaginary line probably limiting the 32-inch minimum mean annual rainfall area in Kansas would practically coincide with the westmost border of the optimum chinch bug area.

Data of this type, when brought together for all the states, will possibly show a maximum rainfall limit. It may not be an annual mean but a monthly maximum or even a daily maximum within a very limited period.

Cases may develop in which an entirely different factor or group of factors may be critical, such as elevation, rate of evaporation, intensity of light, soil, vegetation, or natural enemies. Can anyone doubt that the determination of the critical ecological factors will make possible the prediction of insect outbreaks? Is it not evident, if an insect is confined to a given region in which a given set of known conditions prevail, and if this insect only occurs outside of this region when the conditions in the contiguous territory are modified, either by departures from normal climatic conditions or by the handicraft of man, that we can, by examining the known conditions with the current conditions, foretell insect outbreaks as accurately as weather conditions are now prognosticated?

Another phase of the value of Survey work is the forecasting of the probable spread of newly introduced pests. This, of course, is subject to much more frequent error than the direct record type of forecasting just outlined. In this work we take the normal range of a closely allied species and use this as an index of the possible extent of its newly introduced congener. For example, the Mexican bean beetle within the last few years has become a serious pest in the Lower Mississippi Valley region. This pest was normally confined to the foothill regions of the Southwest and Mexico. It is now well established over Alabama, parts of Georgia, North Carolina, South Carolina, Tennessee, and Kentucky. How far to the North, South, and East will this insect be able to maintain itself? We turn to the closely related species, *Epilachna borealis* as an indicator and find that this species has been recorded over practically the entire humid austral region of Merriam. The two beetles hibernate under very similar conditions. The normal food of the introduced species is abundant throughout this entire region, so we have evidence which should lead the thinking entomologist to organize for the advent of this species as far north as Southeastern Massachusetts

and Southern Michigan. Of course, *Epilachna corrupta* may not be able to withstand the winter conditions that *Epilachna borealis* tolerates, but there is no better criterion in such cases than that here suggested.

A second function of the Survey is its service; this, though but incidental to its main object, is of considerable value. The Survey attempts to discover and rapidly disseminate information relative to recently introduced pests; unusual epidemics of native or well established pests; and migration and first appearance of destructive migratory insects, indicating the rate and direction of migration; also to collect statistics and complete data regarding losses occasioned by insect pests. The reporting of newly introduced pests should be carried on in close co-operation with the Federal Horticultural Board, State Plant Boards, Nursery Inspection Services, and other regulatory organizations throughout the country.

A Survey should not investigate life histories of insects, devise means of control of pests, or undertake extension or eradication work.

The Insect Pest Survey is a co-operative organization in the broadest sense of the word. It obtains its data through collaborators in the several States, Fifty-nine collaborators are now functioning. These are largely Entomologists of the Agricultrual Experiment Stations, State Entomologists, and Entomologists in the State Universities and Agricultural Colleges.

The organization of the Survey may be divided into two branches: One, the Headquarters Office, known as the Office of the Insect Pest Survey of the Bureau of Entomology, United States Department of Agriculture, Washington, D. C., and the other, the Collaborators' Offices located in the several States.

The Headquarters Office functions in receiving all notes from the collaborators, maintaining files of these notes in such a form as to be always immediately available, reviewing literature, mapping distribution, and summarizing these reports immediately for monthly, and later in a more critical manner, for the annual publications. It correlates the insect data received with the climatological, topographical, and ecological data to which it has access, and, finally, draws conclusions based upon these investigations. It should, eventually, have a corps of trained surveyors who could be sent out on special surveys augmenting the survey forces in the several States and teaching survey assistants at the stations approved methods in order to make the results more easily comparable.

The collaborators' offices function in directing the field surveys in

their respective territories, correcting, revising, and otherwise preparing notes for transmittal to Washington, and assume responsibility for all contacts necessary in carrying on Survey work in their respective territories.

The Survey uses four channels through which to disseminate the information gathered. (1) Very urgent information that might be of practical value to the working entomologists is transmitted by telegraphic reports. (2) Matters of immediate interest, but not of so urgent a nature as the telegraphic reports, are published in the form of mimeographed sheets in a continuous series known as Special Reports. These are usually issued within three days after the information is received in Washington. (3) A Monthly Bulletin is issued for the timely dissemination of information on distribution, abundance, and destructiveness of insect pests. (4) The Annual Summary for a final digest of each year's survey activities.

During the last two years 15 numbers, comprising two volumes, of the Bulletin have been issued, covering 565 pages. Up to December 1 of this year the Survey had received notes on 868 species of insects of economic importance. This, in itself, is worth considering, as it visualizes the enormous complexity of our science. In two years 868 different organisms have come to the attention of the American economic entomologist, each organism with individual differences which must be known by the economic entomologist before he can proceed intelligently with control measures. Without a survey, to coordinate and furnish continuity to these records, would not the mass of this information have been lost to the general advancement of our science?

The Insect Pest Survey is now well launched, the co-operation of the Entomological agencies in the several States has been most encouraging, and any deficiencies have been, I believe, in every case due to a failure to appreciate the scope of our work. This activity is fundamental research on a very comprehensive scale and I believe that with your hearty support, will accelerate the advancement of entomological knowledge as will no other one activity to which we are now bending our efforts.

PROGRESS REPORT OF INVESTIGATIONS RELATING TO REPELLENTS, ATTRACTANTS AND LARVICIDES FOR THE SCREW-WORM AND OTHER FLIES

By F. C. Bishopp, F. C. Cook, D. C. Parman, and E. W. Laake, *United States Department of Agriculture*

Abstract

Among many tests of baits for use against the screw worm fly, (*Chrysomya macellaria*) and its relatives dried egg was found to be one of the most satisfactory. Over two hundred chemicals were tested as repellents for use on live stock. Some of the most promising were furfural, safrol, salicylic aldehyde, several essential oils—namely cloves, cassia, citronella, fennel, sassafras and anise—pine tar oils and certain camphor oils. A very effective repellent for practical use is a mixture of one part furfural to four parts pine tar oil. As a larvicide for use on wounds benzol is satisfactory.

The need for a detailed study of the chemotropic responses of various species of flies has been pressing for years. The economic importance of one phase of the problem, viz., the losses caused by the screw worm and other blowflies is world wide. In the southwestern United States they cause a loss to the live stock industry estimated at four million dollars per year. The losses to the sheep industry of Australia are placed at twenty million dollars annually and heavy losses are experienced in tropical America, India and Africa.

The problem of their control has been under investigation by the Bureau of Entomology since 1915 when an investigation of the relation of flies to the packing houses under government control was undertaken in co-operation with the Bureau of Animal Industry. A study of the control of the screw worm fly in the Southwest was started the same year. During the past two years the Bureau of Chemistry has co-operated in the work on these investigations and they have been pushed whenever seasonal and other conditions were favorable.

The field is large, covering the responses of different species of flies to various chemicals, etc., both attractants and repellents. While considerable progress has been made the problem has many aspects and it is planned to continue the co-operative work and to apply the information obtained in the present studies to other species of flies.

The experiments thus far have been divided into three groups (1) Seeking chemical groups or combinations that will attract flies of economic importance, especially blowflies and house flies, (2) Seeking groups or combinations which will repel these flies from decomposing meat or similar materials which are particularly attractive to them, (3) Seeking ovicides and larvicides suitable for use on infested live stock.

In the early stages of the work jars containing meat were treated with

various chemicals and other substances. Records of the number of flies in each jar at different times each day, the presence of eggs and larvae and the ovicidal and larvicidal effects of the chemicals were made. In addition to testing the chemicals directly on meat in jars, experiments were made in which they were incorporated with carriers such as mineral oils, petrolatum and inert powders, and applied to the meat or to wounds.

Some two hundred substances were tested and of these a few such as acetone and amyl butyrate apparently have attractive qualities for flies. Others, such as furfural, safrol and salicylic aldehyde, several essential oils, viz., anise, cassia, clove, citronella, fennel and sassafras, various pine oils, certain camphor oils and artificial mustard oil have shown definite repellent value. The pine tar oil having the greatest repellent actions has not been determined nor have we determined the exact status of all the various substances mentioned.

Several chemicals have been found to possess a larvicidal effect. Among these are nitrobenzene, bromoform, furfural, safrol, pyridine, sassafras oil, salicylic aldehyde and others, but many are too toxic to be used on animals. It will be noted that repellent and larvicidal actions are, in some instances, shown by the same material. Some larvicides are not sufficiently toxic to larvae to warrant their use on wounds and many lack the volatility needed to produce a larvicidal action deep in the tissue.

Of the larvicides for wound treatment 100% benzol has been found more satisfactory than chloroform, xylol or carbon tetrachloride. Cresols and phenols are not to be generally recommended. Bromoform, while satisfactory for use on wounds, is very expensive.

The first practical problem was to find satisfactory materials for application to animals infested by the screw worm fly. These materials must exert repellent properties for several days, i. e., until the wound heals and therefore is not attractive to flies. They should also be non-injurious to the host and preferably have larvicidal action. They must adhere well and possess certain other properties. Of the various mixtures tested several have shown some value and one composed of one part of furfural and four parts of pine tar oil has proven very satisfactory. Another economic phase of the problem is to find repellents suitable for use in protecting meat and other food stuffs from fly contamination.

The second practical problem was to find effective bait for blowflies. This bait must be suitable for shipment and for use in various places where flies may be trapped, such as around slaughterhouses, on ranches,

etc. Gut slime, the mucous lining of hog and cattle intestines removed during their preparation for sausage casings, is very attractive to these flies. As fresh slime can not be shipped the drying of the material was tried. The dried product however, proved less attractive to the blowflies than the fresh slime probably due to the volatilization of amines and ammonia and certain acids during the drying process. The bacterial flora was also reduced by the drying.

Experiments conducted recently have shown that dried whole egg or dried egg yolk when moistened and kept alkaline makes a very attractive bait for flies. The dried egg material which is available commercially and that which may be made from eggs not suitable for food has given excellent results around packing houses and on the cattle ranges. Dried egg material made from off grade eggs must be clearly labeled to show that it is unfit for food purposes. A reduction in the number of screw worm cases among cattle has been noted on ranches where this bait has been properly used with traps.

A mixture of dried egg, water and sodium carbonate in the following proportions is recommended: 170 grams (6 ozs.) dried egg, 2 quarts of water, and 5 grams (1/5 oz.) sodium carbonate. The mixture should be placed in clean bait pans under suitable traps. It is important to keep the bait moist, and to add sodium carbonate occasionally to keep the mixture alkaline.

Other protein material such as rabbit carcasses may be used in traps, the essential point being the development of protein decomposition products and their expulsion by alkaline conditions. The objection to the development of fly larvae in baits composed of meat products has been met by the use of a larvicide surrounding such baits in the pans. Solutions made by mixing 10 cc. (1/3 oz.) of 40% nicotine sulphate solution or by dissolving 15 grams (1/2 oz.) of borax in 2 quarts of water proved satisfactory.

The species of flies studied principally in the tests of attractants and repellents were (arranged approximately according to abundance) *Musca domestica* L., the screw-worm fly (*Chrysomya macellaria* Fab.), black blowfly (*Phormia regina* L.), greenbottle fly (*Lucilia sericata* Meig.), *Piophila casei* L., *Sacrophaga* spp., and *Ophyra leucostoma* Weid.

THE CITRICOLA SCALE IN JAPAN, AND ITS SYNONYMY

By CURTIS P. CLAUSEN, *Yokohama, Japan, United States Department of Agriculture, Bureau of Entomology*

During the seasons of 1916–17 the writer had occasion to make a study of the citrus insects of Japan with particular reference to the securing of parasites for use against these pests in California. The number of soft scales attacking citrus is quite large, and infestations almost invariably comprise several species. Chief among these are the *Pulvinaria* spp., which always occur on every tree. Prior to the formation of the ovisac certain of these are not readily distinguishable in the living condition from several species of *Coccus* infesting the same host plants. Among these latter were occasional individuals which bore a striking resemblance in coloration and form to the citricola scale of California. Later observations also revealed the fact that the eggs hatched almost immediately after being laid, this feature of the life history also being identical with that of the above mentioned species. A quantity of adult females in alcohol were forwarded to Prof. H. J. Quayle for examination, but unfortunately their condition was not such as to permit of a positive determination. Dr. S. I. Kuwana expressed the opinion that it might possibly be his *Lecanium pseudomagnoliarum*.

During 1920–22 further observations have been made and a series of specimens in balsam forwarded to the Bureau of Entomology for determination. Mr. H. Morrison, who made the examination, states that they agree perfectly with specimens of *Coccus citricola* Campbell, in morphological characters but that the specimens show some characters not conforming to the description of *L. pseudomagnoliarum*.

The latter species was described from Oji, near Tokyo, on *Poncirus trifoliata*, and an examination of the hedge from which the type material was taken showed only *C. citricola* such as had been collected elsewhere on this plant. No other species of *Coccus* were present. Arrangements were made to examine the type slides in the collection of the Nishigahara Agricultural Experiment Station and to compare them with specimens from the same series as had previously been determined by Mr. Morrison. This detailed comparison was made both by Dr. Kuwana and by the writer, and the conclusion arrived at that the two series differed in no greater degree than is common within a species of this genus. *Coccus citricola* Campbell (Entom. News, Vol. XXV, No. 5, p. 222–24, May 1914) therefore becomes synonymous with *Coccus* (*Lecanium*) *pseudomagnoliarum* (Kuwana) (Jl. Entom. & Zool., Pomona Col., Vol. VI, No. 1, p. 1–8, 3 pl., March 1914).

This species has been observed by the writer at Yokohama, Okitsu, Kobe, Moji and Nagasaki, as well as at Oji, the type locality, and its distribution therefore covers the entire range of the citrus belt in the main islands of Japan. The favored host plant is *P. trifoliata*, though it has also been observed upon the pomelo and the Unshu orange. In no instance has the scale been found in large numbers, in fact only isolated individuals can be found upon the last named hosts. The life history and habits as observed are identical with those of the species in California.

While the wide distribution in the citrus growing districts of Japan indicate that it is a long established species, yet there is doubt as to whether this is its native home. Most, if not all, of the species and varieties of citrus in Japan, with the exception of the naval orange, have come from the Asiatic mainland, though dating back some three hundred years or more. Consequently it will be necessary to study the representatives of the genus from continental Asia before this point can be finally determined. The California infestation may with reasonable certainty be considered as of Oriental origin.

Scientific Notes

Liponyssus bacoti Hirst. A mite that heretofore has not been recorded from Maryland and which has been determined by Dr. Ewing as the above caused the employees of an umbrella factory to threaten to leave unless the mites were eradicated. Help was asked of this department and an examination by Mr. Sanders disclosed the mites in the cloth and scraps. They were crawling rapidly about over the goods and they readily attacked the employees, causing a swelling like that produced by the chigger. The second floor, occupied by a pants maker was slightly infested but the first and fourth floors which were kept fairly clean were uninfested. This was on January 24, 1923 and on February 16, 1923, after a commercial rat extermination company had been at work for several weeks, the mites had entirely disappeared. ERNEST N. CORY, *State Entomologist, University of Maryland.*

Powder-post beetles (*Lyctus* spp.) **and Automobiles.** The work of powder-post beetles in well seasoned wood is somewhat common and turns up in many unexpected situations. One of the latest is a complaint of the work of these beetles accompanied by injury to upholstering in one of the high priced, popular makes of automobiles. There have been in recent years several reports of powder-post beetle work in the trim of apartment houses in New York City. The trouble in every case has been due to the use of sapwood. This should be treated with some preservative before being incorporated into a costly building or an expensive machine because there is no very satisfactory method of handling the problem later, aside from the use of heat, and this simply kills the insects in the wood and does not prevent re-infestation.

E. P. FELT

Zoological Record assisted by the Imperial Bureau of Entomology. The attention of Entomologists throughout the world is called to the fact that, beginning with the Volume for 1922, the preparation of the "Insecta" part of the "Zoological Record," is being undertaken by the Imperial Bureau of Entomology. In order that the Record may be as complete as it is possible to make it, all authors of entomological papers, especially of systematic ones, are requested to send separata of their papers to the Bureau. These are particularly desired in cases where the original journal is one that is not primarily devoted to entomology. All separata should be addressed to:—The Assistant Director, Imperial Bureau of Entomology, 41, Queen's Gate, London, S. W. 7, England.

Tachinids and Sarcophagids Established in Mexico. It may be noted that as a matter of record the two flies *Euzenilliopsis diatraeae* Towns., and *Sarcophaga sternodontis* Towns., each parasitic on *Diatraea saccharalis* Fab., have recently been introduced into the west coast region of Mexico, from Cuba. A total of 590 adult flies of the two species were reared from some 2,550 puparia sent by the writer from the provinces of Matanzas and Habana, Cuba, during the summer of 1922, and were released on the plantations of the United States Sugar Companies, S. A., at Los Mochis, Sinaloa, Mexico. The exact number of each species released is uncertain, but the bulk of the puparia sent were of the Tachinid species. These introductions were made with a view to the control of *Diatraea lineolata* Walker, which, with *Chilo loftini* Dyar, is a sugar-cane pest of major importance in the state of Sinaloa.
R. H. VAN ZWALUWENBURG, *United Sugar Cos., S. A., Los Mochis, Sin., Mexico*

The Tropical Fowl Mite (*Liponyssus bursa* Berlese). This mite has been reported from two places in the United States,—Beltsville, Md. and Raymond, Ill. (U. S. D. A., Dept. Circ. 79, 1920).[1] According to the writer of the circular, both of these infestations were stamped out through active measures taken by officials of the United States Department of Agriculture. On Jan. 10, 1923, a student in the Winter Course at Cornell, brought me some feathers from fowls heavily infested with a mite. All stages of the mite were present and the fluffy parts of the feathers were almost a solid mass of eggs, nymphs, adults, cast skins and excreta. On examination it proved to be the tropical fowl mite. This student told me that he had this mite on his fowls for the past two years. He obtained some infested feathers from his fowls and the mite proved to be the same species. Accordingly the writer can report the presence of this mite at Closter, New Jersey and in two poultry yards here at Ithaca. In talking with this student he told me that his infestation appeared on his Plain Polish White fowls shortly after he had exhibited them at the Boston Poultry Show two years ago. He has had serious trouble from this mite and has been unable to control it. As the English Sparrow is a host of this species he eliminated this bird from his yards, cleaned up his fowls but still they would become seriously infested within a short time. As the Starling is a common bird about Closter, N. J. and it is known to be a host of this mite the reinfestations probably came from this source.

This mite is undoubtedly a serious pest of poultry and is said to be a carrier of spirachaetosis of fowls. Although this disease has not been recorded from the

[1]It has also been reported recently from the Poultry houses of the Indiana Agr. xp. Sta. at Purdue, Indiana as *Liponyssus silviarum*.

United States there is every probability that it may be introduced and should it become established and this mite prove a distributor of it, the seriousness of the pest would be greatly increased.

ROBERT MATHESON

The "Language" of Bees. In the *Scientific American* for August 1922, there appeared a review of an article on *The "Language" of Bees*. There was an abstract of this review in the *Literary Digest* for Sept. 2, 1922. Altho both periodicals are widely read, these reviews appeared in such inconspicuous places in their columns that it seems doubtful whether the results reported therein are yet before the bee-keeping fraternity in America. In fact, it was not until November that these articles came to my attention. The original paper, which was published in the *Munich Medizin Wochenschrift* (1922), was by Prof. Karl von Frisch, a German investigator.

The results of Von Frisch's experiments lead to the conclusion that the "dance" performed at times by loaded fielders just returned to the hive, is a means employed to inform the other bees that food is to be had for the getting. This method of communication, however, is inadequate to give the location of the food unless that be already known to the recipient of the message.

I deem it a privilege to be able, at this time, to confirm the conclusion of Prof. Von Frisch thru observations and experiments of my own on this very subject which have been carried on here at the Iowa Experiment Station at intervals ever since the summer of 1919. A brief description of the "dancing" bee as seen in a one frame observation hive appears in my notes on "Behaviour of Water Carriers" recorded Dec. 29, 1919, and is as follows: "Attention was soon attracted to certain individual workers that would come in, bustling and business-like, thru the throng. Such an individual was soon set upon by other workers (the number varying from 2 to 5) that followed her as she turned round and round, darting this way and that in make-believe efforts to free herself from these meddlers, like a puppy with a bone, set upon by other puppies."

In my notes for April 19, 1920, under the caption, "Some Maneuvers Seen in an Observation Hive," I referred to the above description and recorded my tentative conclusion regarding the significance of the "dancing" bee as follows: "Characteristic of a worker that *has located a source of pollen, nectar or water* and has a load to give up. Possibly such a bee is *trying to attract the attention of other bees in order that they may help carry home the plunder.*"

On the same day, April 19, 1920, I reported the above conclusion to Dr. E. D. Ball, who at that time had supervision of my work and who now is Director of Scientific Research in the U. S. Department of Agriculture. A few days later, I confided the matter to Prof. F. B. Paddock, State Apiarist of Iowa, and since that time have mentioned my observations on this subject to a limited number of others.

Further observations showed that, with some exceptions, an individual that attempted to approach the "dancer" left for the field in less than two minutes after coming in contact with her. Some would leave at once but others appeared to find it necessary to prepare for the trip by securing a little food from other bees or from a cell.

Thus, working independently, the two of us arrived at the same conclusion at about the same time.

WALLACE PARK
Iowa Experiment Station

JOURNAL OF ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

APRIL, 1923

The editors will thankfully receive news matter and other items likely to be of interest to our readers. Papers will be published as far as possible in the order of reception, except that papers of reasonable length may be accepted in the discretion of the editor for early publication, at $3.00 per page for all matter in excess of six printed pages; in the case of other matter, the maximum of 2,500 words is still operative. Photo-engravings may be obtained by authors at cost.

Separates or reprints, if ordered, when the manuscript is forwarded or the proof returned, will be supplied to authors at the rates given below. Note that the number of pages in a reprint may be affected somewhat by the make-up, and that part of a page is charged as a full page. Carriage charges extra in all cases. Shipment by parcel post, express or freight as directed.

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It would appear that abstracts are somewhat acceptable or that most of our readers are conservative and willing to give the plan a test before expressing an opinion. Most of the abstracts in this issue were prepared by the authors, those who should know the contents of the individual papers. The abstracts in the February number were prepared by the editor and revised more or less by the various authors. It should be possible to develop shortly a type of abstract which may prove of great service to all readers. The viewpoint of the man unacquainted with the subject matter should be kept constantly in mind. The JOURNAL, thanks to the efforts of the Business Manager, the Circulation Agent and their numerous helpers, has a wide circulation distribution. It is not too much to hope for a much greater increase in the number of subscribers. Well prepared abstracts may greatly aid by bringing the contents of the JOURNAL to the favorable attention of many who at first could not be induced to read entire articles. The abstract is one method of emphasizing the interdependence of the various branches of science, since it is a great convenience to workers in allied lines and may easily result in economic entomology coming more nearly to filling the important sphere falling within its domain.

Current Notes

Mr. W. G. Garlick, B.S., University of Toronto, holds a fellowship in Entomology in the University of Kansas.

Prof. H. A. Gossard spent a week during the holidays with his aged mother and other relatives in Iowa.

Mr. R. H. Beamer has been elected to the position of Assistant Curator of the Entomological Collections of the University of Kansas.

Mr. E. H. Siegler of the Bureau of Entomology attended the annual meeting of the Maryland Horticultural Society at Frederick, Md., January 9-11.

According to *Science,* Dr. G. H. Carpenter, Professor of Zoology at Royal College of Science, Dublin, has been appointed Keeper of the Manchester Museum.

The following appointments in the Bureau of Entomology are announced: W. W. Porter and J. A. McLemore, Mississippi and Torbert Slack, Louisiana, sweet potato weevil eradication.

Miss M. E. Bellows and Miss Jean Bostock have recently been appointed laboratory assistants in the Division of Systematic Entomology, Entomological Branch, Canadian Department of Agriculture.

According to *Experiment Station Record,* Mr. J. S. Yankey, inspector in the Department of Entomology and Botany, Kentucky Station, has been succeeded by Mr. Max Braithwait.

Miss Kathleen Doering, A.B., University of Kansas, has been elected to the position of Assistant Instructor in Entomology and Scientific Illustrator in that Institution.

Dr. Herbert Spencer, Assistant Professor of Entomolgy and Zoology, North Carolina College, has been appointed Associate Entomologist in Charge of Investigations of Insects Affecting Truck Crops.

Mr. P. A. Readio, Instructor of Entomology in the University of Kansas, has recently been placed in charge of the Experimental Laboratory and Insectary of that Institution.

Mr. A. J. Ackerman of the Bureau of Entomology was slated to attend the meeting of the Ohio State Horticultural Society, Columbus, Ohio, January 30 to February 1.

Dr. W. M. Wheeler gave the address of the retiring President at the dinner of the American Naturalists at the Boston meeting. His subject was "The Dry Rot of Academic Biology."

Mr. A. B. Baird returned to Fredericton, N. B., on February 9 after spending four weeks rearranging certain subfamilies of parasitic Hymenoptera in the Canadian National Collection of Insects at Ottawa.

The following transfers in the Bureau of Entomology have been announced recently: W. D. Whitcomb, Yakima, Wash., to New Orleans, La.; C. A. Weigel, temporarily, Washington, D. C., to New Orleans, La.

Dr. H. B. Hungerford, Professor of Entomology in the University of Kansas, will be on the instructional staff for research and investigation at the Univeristy of Michigan Biological Station next summer.

Announcement has been made of the following resignations in the Bureau of Entomology: H. B. Lancaster, junior entomologist, Mexican bean beetle, Alabama; F. B. White, plant quarantine inspector, sweet potato weevil, Mississippi.

Professors J. Chester Bradley, O. A. Johannsen and Robert Matheson will be instructors in entomology at the Cornell University Summer School of Biology at Ithaca, N. Y., July 7 to August 17, 1923.

Mr. T. E. Holloway of the Bureau of Entomology will travel through Mexico

during the fiscal year of 1923, for the purpose of investigating sugar-cane insects and the distribution of the cotton boll weevil.

Professor C. E. Sanborn, Professor of Entomology at the Agricultural and Mechanical College of Oklahoma, is on Sabbatical leave and now taking work at the University of Kansas as a candidate for an advanced degree.

Mr. O. I. Snapp of the Bureau of Entomology addressed the meeting of the Tennessee State Horticultural Society, January 30, and attended a meeting of the Science Club of the University of Georgia on February 23.

Mr. C. H. Curran, B. S., University of Toronto, has recently completed his work for an advanced degree at the University of Kansas and has accepted an appointment on the staff of the Dominion Entomologist of Canada.

According to *Science*, Dr. James G. Needham of Cornell University, who is spending the year at Pomona College, gave an address at Los Angeles on February 10 before the Sigma Xi Club of Southern California.

Dr. J. K. Haywood of the Bureau of Chemistry and Chairman of the Federal Insecticide and Fungicide Board, is now absent on a two month's assignment in California, where he will study problems relating to insecticides and foods.

Mr. C. H. Popenoe of the Bureau of Entomology attended the convention of the National Canners Association at Atlantic City, N. J., during the week of January 24, and supervised the installation of the exhibit of the Bureau of Entomology.

Volume XIV of the University of Kansas *Science Bulletin* is now in press. This volume will be devoted entirely to Entomological papers, results of investigations of members of the faculty and graduate students of the Department of Entomology.

According to *Science* Mrs. Anna Botsford Comstock has beeen nominated for trustee of Cornell University. Mrs. Comstock was nominated for this position in 1922, and, though losing by a narrow margin, polled a larger vote than any previous winner.

On February 13 at the meeting of the New Jersey Mosquito Extermination Association, Dr. T. J. Headlee was presented with a gold watch in commemoration of his ten years' service as Secretary of the Association and as State Entomologist of New Jersey.

On February 14, Dr. L. O. Howard, Chief of the Bureau of Entomology, read a paper before the tenth annual meeting of the New Jersey Mosquito Extermination Association at Atlantic City, N. J. On the 13th, he addressed the Japanese Beetle Club at Riverton, N. J.

Prof. H. L. Viereck of the Biological Survey, while in Philadelphia the last week of February, compared specimens of Hymenoptera in the Biological Survey collection with type specimens in the collection of the Academy of Natural Sciences with a view to ascertaining correct identifications.

The laboratory of the Bureau of Entomology at Wallingford, Conn., has been discontinued and Dr. B. A. Porter has been transferred to Vincennes, Ind., where, in co-operation with the Purdue University Agricultural Experiment Station, investigations will be undertaken of the more important fruit insects of southern Indiana.

C. P. B. Lawson, Professor of Entomology in the University of Kansas, has recently been selected as Assistant Dean of the College of Liberal Arts and Sciences at

the University of Kansas. Dr. Lawson will devote half of his time to administration and half to research and teaching.

Mr. C. H. Popenoe, entomologist, Truck-crop Insect Investigations, Bureau of Entomology, recently attended the convention of the National Canners' Association at Atlantic City, N. J., January 22-26, having charge of the Bureau of Entomology exhibit on the European corn borer, Japanese beetle, pea aphis, and other truck crop insects.

At an Institute for Tree Workers at the Agricultural Experiment Station, New Haven, Conn., March 1, arranged by the Tree Protection Examining Board of the State of Connecticut, illustrated entomological addresses were given as follows: Mr. A. F. Burgess, "The Gipsy Moth;" Dr. E. P. Felt, "Some Insects Attacking Shade Trees."

Dr. E. D. Ball left Washington February 4 for Memphis, Tennessee to attend the meeting of the Southern Agricultural Workers. Before returning to Washington, Dr. Ball was scheduled to give addresses at Manhattan, Kansas, and Ames, Iowa, and to visit Lincoln, Nebraska, to confer with the University officials on research problems.

Mr. William Middleton of the Bureau of Entomology returned to Washington on January 18 after a short trip to Columbus, Ga., for the purpose of investigating the conditions of the sugarberry shade trees of that city, which are infested by scale insects, and advising the municipal authorities regarding methods of control.

Dr. M. D. Leonard of the Bowker Insecticide Company has been appointed Associate State Entomologist of New York and will take charge of the office of the State Entomologist May 1, an arrangement necessitated by the transfer of Dr. Felt to the State Conservation Commission.

The laboratory of the Bureau of Entomology at Medford, Oregon, has been discontinued, and M. A. Yothers, who has been in charge of this station, has been transferred to the bureau's laboratory at Yakima, Wash., where he will be associated with E. J. Newcomer in the continuation of fruit insect investigations of that region.

At a meeting of the American Agricultural Editors Association, held February 27 and 28 at the Department of Agriculture, Washington, D. C., the following addresses were made by entomologists: "The value of Research," Dr. E. D. Ball; "Plant Quarantine Laws," Dr. C. L. Marlatt; "Recent Advances in Fruit Insect Control," Mr. E. H. Siegler; "Apiculture," Dr. E. F. Phillips.

Mr. J. E. Dudley, Jr., assistant entomologist, Bureau of Entomology, stationed at Madison, Wis., recently attended the National Canners Association Convention at Atlantic City, N. J., January 22-26, where he presented a paper outlining the plans of the department in undertaking work against the pea aphis in Wisconsin and other portions of the United States, in co-operation with State Entomologists and representative canners.

Dr. E. D. Ball returned February 24 from a speaking trip in the course of which he addressed the New York Farmers' Club at New York City; on February 21, the Japanese Beetle Club at Riverton, N. J., on February 23, the Journal Club of the Department of Medical Sociology of the School of Hygiene and Public Health of Johns Hopkins University.

Mr. Wilmon Newell, director of the Florida Agricultural Experiment Station,

visited Washington January 9, and reported that plans have been made by the Station staff and co-operative extension workers of Florida and the cotton growers of the State for a general trial of the boll weevil eradication method practiced for the first time by that Station last season with promising results.

The field leaders in the Hession fly investigations of the Bureau of Entomology conferred in Washington on January 3. Those in attendance were W. H. Larrimer, W. B. Cartwright, A. F. Satterthwait, J. R. Horton, C. C. Hill, C. M. Packard, J. S. Wade and W. R. Walton. Messrs. P. R. Myers and W. J. Phillips were prevented from attending by illness. The conference, as usual, yielded valuable results in the co-ordination of methods and effort.

Mr. A. F. Satterthwait, in charge of the Webster Groves, Mo., station of the Bureau of Entomology recently broadcasted a lecture from St. Louis, Mo., telling of the functions of the Webster Groves station and its relation to the agriculture of the region. This was part of a series of talks arranged by the local U. S. D. A. Club with a view to popularizing the work of the department.

The Australian tomato weevil (*Desiantha nociva* Lea) has been found to be established at a number of points along the coast of Mississippi in addition to the previous inland infestation. It is now reported from five distinct places in Harrison County, two in Stone County, and one in Jackson County. This indicates that the original introduction occurred presumably at an earlier date than was heretofore supposed.

The brown-tail moth work in New Brunswick was completed on January 27 by Messrs. Finnamore and Simpson. Practically the same area was covered as in 1921-22 and no sign of the insect was seen. The work in Nova Scotia has been seriously handicapped by the very severe snow storms. Up to January 27, 422 winter nests have been collected as compared with 757 for the same period last year.

The legislature of New York has passed a bill giving the Conservation Commission wide discretionary powers for the control and preventing the spread of the gipsy moth and appropriating $150,000 for the work, thus legalizing the barrier zone which has been under discussion for the last few months. Mr. H. L. McIntyre of the Federal Gipsy Moth work has been appointed Superintendent and Dr. E. P. Felt, Chief Entomologist, the latter being transferred from the office of the State Entomologist with tenure of title.

A New Entomological Laboratory in Ceylon.—In the November issue of *The Tropical Agriculturist* which is published at Peradeniya, Ceylon, an account is given of the opening of a new Entomological Laboratory, which is situated at the very entrance of Peradeniya, the heart of the agricultural life of Ceylon. The Entomological Laboratory consists of two rooms for Entomologists, two for Assistants and students, a dark room, an insectary, a store room, a library and lecture room, a room for collection, and a room for the clerk. The opening of this laboratory and a similar Mycological Laboratory took place on October 10, 1922, at which the Governor was present and made an address, as did the Director of Agriculture for the Colony. In the course of his address the Director remarked that the entomological work in Ceylon reflects great credit upon those scientific workers, such as Mr. E. E. Green and his present successors Dr. J. G. Hutson and Mr. Jepson.

According to *Entomological News*, Mr. Henry John Elwes, F.R.S., F.E.S., died November 26, 1922, at his home, Colesborne Hall, Cheltenham, England, at the age

of 76 years. He was an authority on the Palearctic Rhopalocera, and his extensive travels included portions of North America. He was president of the Entomological Society of London in 1893 and 1894 and was elected a corresponding member of the American Entomological Society in 1897.

At the dinner held Friday afternoon at the University Club an address was given by Doctor W. L. Burlison, Head of the Agronomy Department, University of Illinois on: "What the Entomologist should be doing from the Agronomist standpoint." This was followed by a short symposium on control of field crop insects.

Mr. H. S. Adair, a graduate of the Mississippi A. & M. College, has been appointed field assistant to assist with the plum curculio studies that are being conducted at Fort Valley, Georgia, by the Bureau of Entomology.

On January 30th, Mr. Oliver I. Snapp, of the Bureau of Entomology, with headquarters at Fort Valley, Ga., gave an address at the Annual Meeting of the Tennessee Horticultural Society at Nashville, Tenn., on recent developments in peach insects control. He also spoke on a similar subject at the Annual Meeting of Southern Agricultural Workers in Memphis, Tenn., on February 6th, and at the University of Georgia, Athens, Ga., on February 23rd.

Mr. W. V. Tower, entomologist of the Federal Agricultural Experiment Station, Mayaguez, Porto Rico, has been granted leave of absence from his Station duties to make a study of methods of combating the tobacco, or cigarette, beetle, which is doing considerable damage in the factories and warehouses of the Porto-Rican-American Tobacco Co. Extensive fumigation experiments are to be conducted to determine the possibility of controlling this pest under the conditions prevailing in Porto Rico.

Mr. C. H. Curran, Entomological Branch, Canadian Department of Agriculture, has just returned from a three week's trip to Washington, New York, Boston and Cambridge, where he studied numerous types of Diptera in connection with the determination of Canadian material in various families of this order. Mr. Curran reports that as a result of his work a number of new Canadian species can now be described and the types deposited in the Canadian National Collection of Insects.

A conference of Entomologists of the States in the northern part of the Mississippi Valley was held at Urbana, Illinois, March 2 and 3. The following men were in attendance:—

Mr. J. E. Dudley, E. L. Chambers, C. L. Fluke of Wisconsin; J. W. McColloch of Kansas; K. C. Sullivan, A. F. Satherwait of Missouri; H. T. Dietz, W. H. Larrimer, J. J. Davis and B. A. Porter of Indiana; T. H. Parks, H. A. Gossard of Ohio; J. H. Bigger, C. C. Compton, S. C. Chandler, W. D. Balduf, T. H. Frison, R. D. Glasgow, C. L. Metcalf, P. A. Glenn, S. A. Forbes and W. P. Flint of Illinois.

The following subjects were discussed:—The European Corn Borer; The present chinch-bug situation; The Hessian Fly; The recent increase in damage by San Jose scale and the place of lubricating oil emulsions in control; What attitude should be taken regarding the increase in soybean and cowpea acreage, in view of the threatened invasion by the Mexican Bean Beetle; Garden truck insects; Grasshoppers; Clover insects; Peach tree borer control with para-dichlorobenzene; The present status of dusting; Shall we recommend spreaders; Recent developments in plant disease work and their significance in insect control; New developments in control of sorted grain insects; Peach Thrips; Potato leaf hopper and Forest insects.

Efforts toward the control of the Mexican bean beetle have been rewarded by the discovery of a very promising parasite. Mr. E. Graywood Smyth, who was sent by the Bureau of Entomology in early May to Mexico to search for natural enemies of the bean beetle, has discovered a tachinid parasite that preys upon at least two species of *Epilachna* and seems to restrict itself to that genus. It was responsible for a very high fatality among *Epilachna* larvae in the Valley of Mexico and at Cuernavaca. In the neighborhood of 2,000 living puparia of this fly were sent to the Birmingham, Ala., laboratory and from this material Neale F. Howard, in charge of the laboratory, has succeeded in rearing one generation from native *Epilachna* larvae. A considerable number of puparia are now being held in hibernation for the coming spring. In addition, Mr. Smyth found in Mexico two varieties of beans which show promise of resistance to the injurious attack of the bean beetle, one of them, a native edible white bean, known as "ayocote," which is cultivated on a fairly large scale in sections, the other a wild brown bean of the genus *Phaseolus*. The latter grows very abundantly along streams in southern Mexico, climbing bushes and other vegetation, and the rather leathery foliage which it produces is very seldom attacked by the bean beetle, so that there is a possibility of the bean proving of great value for hybridizing with cultivated varieties to breed a resistant stock.

At the ninth annual meeting of the Entomological Workers of Ohio Institutions held at the Ohio State University, Columbus, Ohio, February 2, the following officers were elected: President, Clifford R. Cutright, Vice-President, J. W. Bulger, Secretary, C. H. Kennedy. Visiting entomologists were: S. B. Fracker, Madison, Wis; W. J. Schoene, Blacksburg, Va; W. H. Larrimer, West LaFayette, Ind; G. A. Runner, Sandusky, O.; F. W. Poos, Sandusky, O.; T. L. Guyton, Harrisburg, Pa ; R. D. Whitmarsh, Wooster, O. The program was as follows: C. R. Neiswander, The Tracheal System of *Ranatra fusca;* J. S. Hine, The History of the Ohio State University Entomological Collection; T. J. Naude, Representative Genera of Cicadellidae in South Africa; E. W. Mendenhall, Some Observations on Economic Entomology; D. M. DeLong, Recent Observations upon Toxicity of Nicotine; J. T. Potgieter, Remarks on South African Aphids; C. R. Cutright, Fall Activities of Some Common Aphids; F. H. Lathrop, The Environment of Aphids; T. H. Parks, A Progress Report of Hessian Fly Studies; J. S. Houser, The Present Status of the San Jose Scale; C. H. Kennedy, A Record Bumblebee's Nest; M. O. Lee, Mechanism of Respiration in Certain Orthoptera; Herbert Osborn, Personal Contact with Pioneer Entomologists; Albert Hartzell, The Potato Leaf-hopper and Hopperburn; H. A. Gossard, Life History of the Codling Worm in Ohio; W. J. Schoene, The Problems and Opportunities for Entomological Investigations in Virginia; J. W. Bulger, Some Researches with Paradichlorobenzine; W. G. Stover, Some Plant Diseases Know or Likely to be Transmitted by Insects; R. C. Osborn (Subject to be selected.); A. E. Miller, The Cabbage Looper and Common Ear Worm at Chillicothe; E. C. Cotton, Steps in the Enforcement of Inspection and Quarantine Regulations. The following resolutions were adopted:

(1) *Resolved,* That the Entomological Workers of Ohio express their thanks to the Federal Bureau of Entomology for the excellent exhibit of photographs and other material to illustrate the work of the European corn borer and that we likewise thank Mr. J. S. Houser for his sucessful effort to secure this exhibit.

(2) That the Entomological Workers in Ohio State Institutions assembled in annual meeting respectfully urge the calling of a national conference to determine the future policy for the control of the European corn borer. This conference to be held preferably at Cleveland during the summer or fall of 1923 and to inc ud

representative farmers, state and federal entomologists of all states affected or likely to be affected by this pest.

(3) That we urge upon our legislature the imperative need of making liberal appropriations for the control of the European Corn Borer by scouting and quarantine methods and for the thorough study of the behaviour of this pest under Ohio conditions.

(4) That we express our appreciation of the efficient and wise management of the Bureau of Plant Industry under the direction of Professor E. C. Cotton for several years, and that we respectfully urge that the high standards maintained by Mr. Cotton shall continue to be maintained in this State Bureau.

(5) That we express our thanks to our visitors from various places for the contributions they have made to our program and for participating in our discussions. We invite them to come again.

(6) That we thank the officials of Ohio State University, particularly those in charge of the Department of Zoology and Entomology, for the rooms and equipment provided for our meeting and other arrangements for our comfort and entertainment.

H. Osborn
H. A. Gossard
Richard Faxon
Committe

Notes on Medical Entomology

Dr. L. O. Howard and Professor C. T. Brues each gave papers on the relation of insects in the transmission of human diseases before Section N, Medical Sciences, at the Boston meeting of the American Association for the Advancement of Science, December, 1922.

Dr. W. V. King, in charge of the investigations of the Bureau of Entomology on malaria mosquitoes at Mound, La., attended the Malaria Conference held at Johns Hopkins University in Baltimore, during January. Dr. King will remain in Baltimore for several weeks working up malaria and mosquito statistics.

The Dallas, Texas, laboratory of the Bureau of Entomology prepared a booth on insects in relation to disease at the Dallas Health Show which was held in Dallas from March 13-17. By means of living and mounted specimens, photographs, models, etc., an effort was made to popularize this field of entomology which is of such vital importance, especially in the South.

Health authorities, sanitariums and entomologists are giving some attention to plans calculated to reduce the chances of another outbreak of dengue fever in the South during the present season. The mild winter which has been experienced in Texas has permitted yellow fever mosquitoes to winter successfully, at least in the coastal region, thus apparently providing an opportunity for the spread of the disease early in the season.

Horticultural Inspection Notes

An interesting Cerambycid, *Nyssodrys contempta* Bates, was recently intercepted at the Inspection House in Washington, D. C., by Mr. H. Y. Gouldman in pulp of "Pejbae," *Guilielma utilis*, from Limon, Costa Rica.

Mr. W. H. Lyne, Inspector of Horticultural Products at Vancouver, B. C., re-

ported on December 21 the finding of sixty beetle larvae among the roots of four plants, part of a consignment from Japan.

Mr. A. G. Webb, in charge of the work of the Federal Horticultural Board at Seattle, Washington, has been temporarily transferred to Washington, D. C., to assist in the inspection of plants introduced under special permit.

Mr. W. B. Wood during the month of February inspected the plants for distribution at the field stations of the Office of Foreign Seed and Plant Introduction at Savannah, Ga., and Brooksville and Miama, Fla.

Mr. E. C. Cotton, who for several years has been chief of the State of Ohio Department of Agriculture, Division of Plant Industry, resigned on February 15, 1923. He has been succeeded by Mr. Richard Faxon.

Dr. W. M. Mann of the Bureau of Entomology is making a special investigation of the fruit fly situation in Mexico for the Federal Horticultural Board. He left Washington early in January and entered Mexico at Nogales, Arizona.

The West Indian Fruit Fly, *Anastrepha fraterculus* Weid., was intercepted by Messrs. E. Kostal and J. W. O'Brien, inspectors at the port of New York City, in mangos from Jamaica on ten occasions during the months of January and February.

Mr. Clyde P. Trotter, who has had about two years' experience in the inspection work on the Mexican border, as well as about eight months' experience in maritime inspection work in New Orleans, La., was recently transferred to Galveston, Texas, to take charge of the work of the Federal Horticultural Board at that port.

Mr. R. D. Kennedy, Inspector of the Federal Horticultural Board in Washington, D. C., recently collected what appears to be *Aspidiotus cryptoxanthus* Ckll., on walnut cuttings, and *Lepidosaphes flava* var. *hawaiiensis* (Mask.) on chestnut cuttings from Shantung, China. Neither of these Coccids are known to occur in the United States.

Egg masses of the gipsy moth, *Porthetria dispar* L., were intercepted during the month of January by Mr. Max Kisliuk, Jr., in charge of the Board's activities at Philadelphia, in cracks and openings of sheet cork which arrived from Bordeaux, France. This is a very fortunate interception and indicates another avenue for the entry of this pest.

The State of California Department of Agriculture has recently issued Quarantine Order No. 41 which relates to Citrus White Flies. This Order supersedes Quarantine Orders Nos. 15, 18 and 21, and is applicable to the States of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisana and Texas. Copies of this Order should be in the possession of the inspectors of the states enumerated.

Mr. Heber J. Webb, Crops and Pests Inspector of Utah, reports that Easter lily bulbs, which were imported from Japan in November, 1922, are now showing serious injury as a result of the presence of *Rhizoglyphus hyacinthi* Boisd. He reports that about thirty per cent of the bulbs failed to grow, and many of the seventy per cent. which grew produced inferior plants which were worthless from a commercial standpoint.

Inspector Ryan of the Entomological Branch, Canadian Department of Agriculture, has continued his investigations on the possibility of spreading the European Corn Borer in shipments of live stock. He found that corn on the cob was often fed to hogs en route to the stock yards. On arrival at Toronto the cars were cleaned, and manure sold to a contractor. The latter shipped the manure to different points.

On account of the serious shortage of broom corn in the United States which may necessitate Canadian broom manufacturers buying their supply in other countries, it has been necessary for the Destructive Insect and Pest Act Advisory Board to advise all broom manufacturers in Canada that shipments of broom corn from countries other than the United States will have to be routed via an United States port for sterilization as there are no facilities for treating such shipments at Canadian seaports.

Larvae of the Pink Bollworm, *Pectinophora gossypiella* Saund., have been found in cotton seed arriving on the Texas border as follows: at Eagle Pass one interception was made by Mr. R. B. Haller; at El Paso larvae were taken by Mr. T. A. Arnold, and a second interception was made by Mr. J. M. Singleton. Two of the above inspectors, namely Messrs. Arnold and Singleton, have also intercepted the Avocado Weevil, *Heilipus lauri* Boh., in avocados arriving from the interior of Mexico on two occasions. In each instance the avocados were in the possession of passengers.

Information has been received from Dr. S. B. Fracker of Wisconsin to the effect that a bill is under consideration in Wisconsin which would provide for the examination and licensing of all individuals or firms applying insecticides, pruning trees, and engaging in other activities along the lines of tree surgery and landscape architecture. The recent rapid increase in the amount of spraying carried on together with the effects of a sleet storm a year ago which required an unusual amount of tree trimming in large sections of the state have caused a popular demand for protection from incompetent workmen in these fields.

Mr. Harry B. Shaw, in charge of the work of the Federal Horticultural Board at New York City, reports that commercial shipments of Italian broom corn are arriving infested with larvae of the European Corn Borer, *Pyrausta nubilalis* Hbn. A careful examination of several bales contained in one of the shipments showed that ten per cent. of the stems bore evidence of borer injury and one-half of one per cent. exhibited larvae. These shipments, as a condition of entry, were sterilized with live steam. Mr. Shaw also reports that a small shipment of broom corn arrived in New York invoiced as buckwheat.

A recent shipment of twelve mango plants received by the U. S. Department of Agriculture from Brazil illustrates very forcibly the danger which accompanies the introduction of plants. Inspectors H. Y. Gouldman and W. T. Owrey, of the Federal Horticultural Board, found these plants to be infested with nine recognized species of scale insects, namely, *Chrysomphalus aonidum* (L.), *Chrysomphalus dictyospermi* (Morg.), *Ischnaspis longirostris* (Sign.), *Howardia biclavis* (Comst.), *Coccus viridis* (Green), *Pseudaonidia trilobitiformis* (Green), *Vinsonia stellifera* (Westw.), *Parlatoria proteus* (Curt.) and *Morganelli longispina* (Morg.). Two additional species were collected, but identifications have not been secured as yet. These plants were also infested with species of Aleurodids and Aphids, and in the soil around the roots were found Ants and Isopods.

Inspector Cameron, Entomological Branch, Canadian Department of Agriculture, attended the Ottawa Winter Fair on January 15-19 and examined all the exhibits of seed corn on cobs on exhibit. Mr. H. F. Hudson attended the Essex County Corn Show on January 15. He reported that the show was the largest on the continent this year and that there were at least a third more corn entries than at the International Show in Chicago. It is estimated that over a thousand bushels of seed corn were shown. Mr. Hudson also attended the Ontario Seed Corn Growers Show

Plate 2

Insect material collected on Manetti rose stocks from France.
(1) Nests of the Sorrel Cutworm, *Acronycta rumicis*, Linn. (2) Egg mass of *Mantis religiosa*, Linn. (3) Cocoons of *Calophasia lunula*, Hufn. (Natural Size).

which was held at Chatham, January 23-26. A total of 142 exhibits consisting of 9,556 ears were shown.

It is evident from reports received from State and Federal inspectors that foreign shipments of fruit and rose stocks are showing considerable infestation with insects which are not known to occur in this country. Infested shipments have arrived during the period January 1 to February 24, 1923, inclusive, as follows: pupae of the Dagger Moth (*Acronycta auricoma* Fab.) from France on fruit stocks, three times, rose stocks, once; nests of the Sorrel Cutworm, (*Acronycta rumicis* L.) from France on fruit stocks, four times; nests of the White Tree Pierid, (*Aporia crataegi* L.) from France on rose stocks, twice, and on pear and cherry seedlings, once; the Snagboring Emphytus (*Emphytus cinctus* L.), on rose stocks from England, eleven times, from France, five times, and from Holland, once; one egg mass of the European Tussock Moth, (*Orgyia antiqua* L.) was taken on pear seedlings from France. Doubtless other interceptions have been made, but have not been reported to Washington as yet. Plate 2 is reproduced for the benefit of those engaged in the examination of nursery stock. The insect material photographed was collected by Messrs. H. F. Dietz and D. C. Johnston. Similar material has been collected by Mr. E. N. Cory and assistants. Plate 3 in Volume 15, No. 1, of the JOURNAL, illustrates nests of the White Tree Pierid in comparison with those of the Brown-tail Moth.

Apicultural Notes

The winter meeting of the Connecticut Beekeepers Association was held in connection with the Mid-Winter Exposition at the State Armory, Hartford, on January 26.

Ontario is to have $15,000.00 for the suppression of brood diseases during 1923: $5,000.00 is reported to come from the Dominion Government and $10,000.00 from the Province of Ontario.

The Bureau of Entomology announces that a set of lantern slides on the anatomy of the honey bee with a lecture condensed from the bulletin by R. E. Snodgrass, is now available for the use of beekeepers' associations. Applications should be made through the county agricultural agents.

On February 7, Dr. E. F. Phillips gave a talk on beekeeping and the use of honey as a food over the broadcasting station of the St. Louis *Post-Dispatch* (KSD). Reports of the receipt of the message have been received from points in Texas, Louisiana, as far east as Buffalo, N. Y., and north to Madison, Wisconsin.

Meetings for beekeepers were held by Purdue University January 29 to February 1 and at Cornell University February 20 to 23, both meetings being well attended by beekeepers of the respective states. Dr. E. F. Phillips of the Bureau of Entomology and Mr. George S. Demuth, editor of *Gleanings in Bee Culture*, took active parts in both meetings.

According to *Gleanings in Bee Culture*, the dedication of the Miller Memorial Library of Apiculture will take place at the University of Wisconsin, Madison, Wis., August 13-18. It is expected that beekeepers from all over the United States and Canada will attend this meeting which will be held by the University of Wisconsin in co-operation with the Wisconsin State Beekeepers Association.

The two motion picture films on bee keeping prepared by the Bureau of Entomology and distributed through the Motion Picture Laboratory of the Department of Agriculture have had an enormous demand. The film showing the life history of the bee has been especially popular and it has been quite impossible for the Department to furnish the film to all persons requesting its use.

Dr. E. F. Phillips addressed a joint meeting of the Society of the Sigma Xi and the Biological Club of Purdue University, Lafayette, Indiana, on "Beekeeping Investigations" on the evening of February 1. He was scheduled to speak before the Ohio State Beekeepers Association, Columbus, Ohio, February 1-2, the American Honey Producers' League, St. Louis, Mo., February 6-9, and to give one of the Ludwig Lectures of the Philadelphia Academy of Natural Sciences at Philadelphia on the evening of April 2.

The American Honey Producers' League held its annual meeting in St. Louis on February 6-8. Important matters which were considered by the convention were color grades for extracted honey and the enforcement of the Act of Congress on August 31, 1922, prohibiting the importation of adult honey bees into the United States, except from countries in which the Secretary of Agriculture shall determine that no disease dangerous to adult honey bees exists. The League will issue a monthly bulletin to its membership during the coming year. Prof. H. F. Wilson was re-elected president and Dr. S. B. Fracker has been chosen as Secretary by the Executive Committee.

The collection of honeys made by the Bureau of Entomology last summer was sent to the annual meeting of the American Honey Producers' League in St. Louis in February, where it attracted much interest. The members of the League in attendance were asked to state individually where, in their opinions, the several color grades should be limited, as based on the samples submitted. There was naturally considerable difference of opinion but by averaging the decisions made individually and by further discussion an agreement was reached, representing the recommendations of the meeting for the establishment of grades. It is expected that in the near future the Bureau of Agricultural Economics of the Department of Agriculture will establish legal grades for this purpose, after which assistance will be given in the duplications of these color grades for the use of beekeepers and buyers of honey.

A conference regarding regulations for the importation of adult honey bees, under the act of August 31st, 1922, was held in the United States National Museum, March 12th. The conference, with Dr. Phillips as Chairman, considered and passed the regulations as submitted by the Department of Agriculture. Regulation 5 was amended to make it clearer that bees could be imported from Canada without restrictions under the law, and, in Section B, by the addition of a clause further safeguarding the introduction of queens from countries in which the Isle of Wight disease does not now exist.

The following men attended the hearing: Kenneth Hawkins, G. B. Lewis Company; R. B. Willson, New York; N. E. Phillips, Pennsylvania; C. L. Marlatt, Bureau of Entomology; E. A. Sherman, Solicitor of the Department; A. P. Sturtevant, Bureau of Entomology; T. K. Massey, State Inspector of West Virginia; G. C. Chase, a Wisconsin beekeeper and George Rea and Ernest N. Cory, representing the apicultural section of this association.